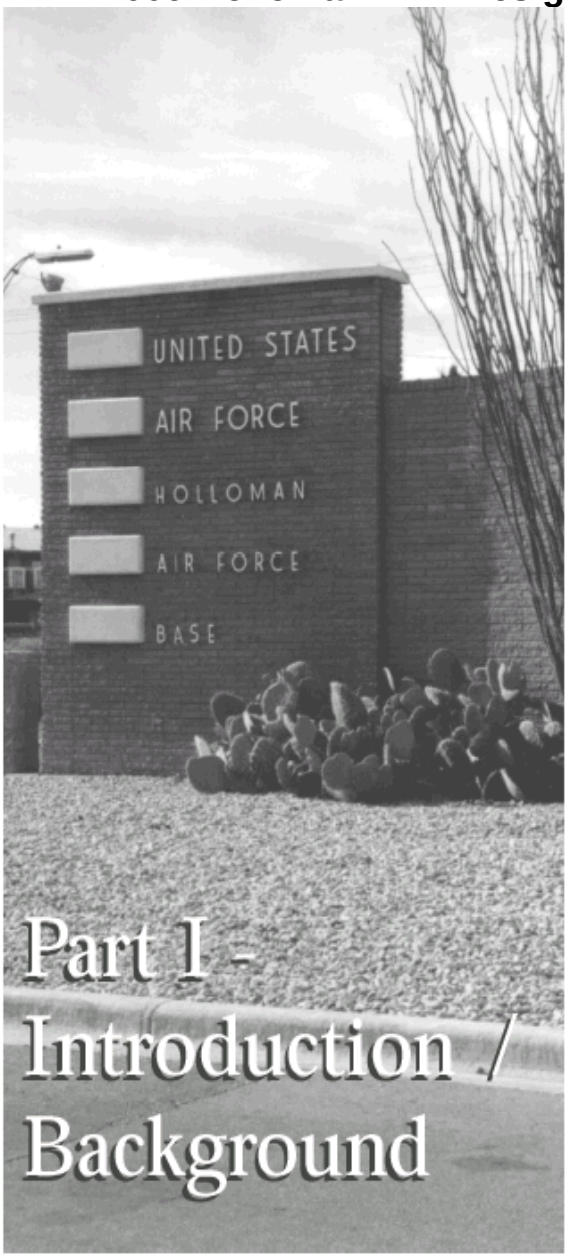
Holloman Air Force Base, New Mexico

* Denotes paragraphs with latest updates.

Design Compatibility Standards



Part I - Introduction / Background

1. EXECUTIVE SUMMARY

Holloman Air Force Base, without the benefit of a "formal" comprehensive design guideline, has in its recent development, established the beginnings of a consistent base wide aesthetic character. An obvious awareness of planning and aesthetic issues as base wide, rather than *only* building specific, has resulted in new construction that can serve as a design bench-mark for future development on the base.

Based on observations of the unique physical environment at Holloman, both natural and built, the standards outlined in this document recognize and further refine the positive characteristics existing on the base and define new approaches that reinforce these positives. They will provide to the base, and to design professionals working with the base, a set of "rules" resulting in a more coordinated and consistent visual and functional character in future base planning and construction. These standards do not limit in any way the functional or aesthetic creativity of any design professional chosen to work at Holloman. Creative, innovative and appropriate solutions to design problems are in fact the minimum expectation.

Holloman has initiated efforts aimed primarily at comprehensive planning of future base facilities and needs. The "Horizons 2000" Facility Improvement Plan and the current Holloman Air Force Base General Plan deal with these broad-scope issues. The Military Family Housing Community Plan deals in a more focused area and touches on aesthetic and design issues with- in the family-housing zone. The 2009 Design Compatibility Standards shall be used in conjunction with, and complement the intent of existing, active planning documents.

All tenant units at Holloman Air Force Base are required to conform to the architectural, landscape, exterior signage and engineering sections of this document.

The Base Civil Engineer and the Chief of the Engineering Flight must approve any minor deviations from the guidelines listed in this document. Air Combat Command must also approve any major deviations from this guideline. Approval is requested via a waiver signed by the Wing Commander and sent to ACC for consideration.

2. BASE MISSION

2.A History

Holloman Air Force Base, originally established as Alamogordo Army Air Field, began construction in 1942 as a temporary wartime base. Primarily serving as a training base for bomber pilots and crews, Holloman is most well known during this period for the detonation, at the Trinity Site, of the first atomic bomb developed under the Manhattan Project. Following a brief deactivation after World War II the base entered a period lasting into the late 1960's focused on research and development, primarily, beginning with pilot-less aircraft, guided missiles and allied equipment. Renamed Holloman AFB in 1948 the base continued in its function of guided missile and space research and development until 1968, when the 49th Tactical Fighter Wing was assigned to the installation. Soon after, the Tactical Air Command assumed command of the base. Upon deactivation of TAC in 1992 command was transferred to Air Combat Command, Holloman's current command. The 49th Fighter Wing, Holloman's current host unit, was born in 1941 and took over host duties in 1991 with the inactivation of the 833rd Air Division. Holloman is currently home to F-22A stealth fighters. As of July 2007, there are 21 German Air Force Tornadoes and 600 German military personnel assigned to Holloman. The German Air Force is the largest associate unit at Holloman. The installation is also home to the 46th Test Group, the 4th Space Surveillance Squadron, the 846th Test Squadron, and many other units and organizations.

2.B Base Components

The 49th Fighter Wing, based at Holloman, is composed of the 49th Operations Group, the 49th Mission Support Group, the 49th Logistics Group, the 49th Medical Group, and the 49th Materiel Maintenance Group.

2.C Mission Statement

Support national security objectives as directed by the Joint Chiefs of Staff with F-22A Raptors. Rapidly mobilize and deploy worldwide to meet peacetime and wartime contingencies. Conduct fighter fundamentals training for selected allied nation aircrews and the F-4F initial training and fighter weapons instructor courses for German Air Force crews. Provide morale, welfare and administrative support for over 6,000 assigned personnel.

3. REGIONAL SETTING

3.A Geographic Setting

Holloman Air Force Base is located seven miles west of the city of Alamogordo in south central New Mexico. About 85 miles north-northeast of El Paso, Texas, Holloman is located within the Tularosa Basin between the Sacramento and San Andreas mountain ranges. The base is easily accessible via State routes 70 and 54.

3.B Climate Setting

The climate at Holloman AFB is significantly influenced by its location between mountain ranges. Basically "high desert" (about 4000 feet above sea level), average precipitation as recorded at the base weather station is 8.5 inches annually with wet bulb temperature $T_{WB} \geq 73°F$ only 3 hours annually The average annual temperature is 62 degrees with seasonal mean temperatures of 41 degrees in January and 82 degrees in July. Daily temperature fluctuations average about 27 degrees.

Strong southerly wind flow, sometimes reaching 73 miles per hour, with periods of blowing dust and sand characterize the March through May period.

The area averages more than 300 days of sunshine per year. Sun angles range from approximately 81 degrees in summer to 33 degrees in winter. Because of the high summer temperature range, the lack of natural shade and the high percentage of sunny days, solar design and control should be addressed on all Holloman design projects.

3.C Geological Setting

The visible natural site character is what might be expected - harsh, flat desert terrain bounded by dramatic mountains. The most dramatic natural feature is the expanse of white gypsum sand dunes found within the White Sands Missile Range and White Sands National Monument. These dunes cover much of the western edge of the base. This gypsum is highly corrosive to ferrous metals, toxic to many plant species and tends to dissolve when exposed to water. The immediate proximity to the gypsum concentration creates high gypsum content soil conditions over much of the installation. As a consequence, indigenous desert flora is noticeably less apparent on the base than it is as close as nearby Alamogordo. Much of the higher profile landscaping on the base grows in imported soil. Gypsum content in the soil does, and will continue to, heavily impact the overall approach to base landscaping, storm water management and the selection of construction materials.

The conditions outlined above describe a location with unusually harsh design conditions in terms of both climate and geology. Site-specific design is mandatory. It is the imperative that each design professional working in this environment recognizes and responds to the specific conditions that exist at Holloman AFB.


Part II -
Architectural
Standards

1. ZONING

Holloman AFB is currently segregated into four functional zones.

1.A Zone 1 - Mission

Includes areas directly related to the operation and maintenance of aircraft (hangars, runways, etc.) and the training of their crews. Also includes areas for maintenance, storage and supply functions not directly related to aircraft facilities. This zone includes all areas roughly north/northwest of the center of Delaware Avenue.

1.B Zone 2 - Mission Support

Includes areas designated for administrative services, maintenance operations, security forces, civil engineer services, and industrial support. This zone occupies the central portion of the base, roughly between Delaware and Connecticut Avenues, and east of First Street.

1.C Zone 3 - Community

Includes areas designated for commercial activities, club facilities, indoor recreation and community services. Dormitories are located in the Community zone.

1.D Zone 4 - Family Housing

Single-family homes provide a higher quality of life for the residents and offer more privacy through the elimination of party walls, reduce building massing and by creating open landscaped areas around all sides of buildings. Single-family homes also instill individual ownership and promote pride and increase interest in home maintenance.

The new and future housing shall be distributed with a maximum density of 4 units per acre. Larger set backs will provide lower densities and improve privacy for residents.

Cul-de-sacs shall been utilized as a primary street system to create smaller clusters of housing and reduce through traffic concerns within the site. This shall create additional resident privacy and minimize units placed on through streets. In new construction the majority of the units shall directly front these private cul-de-sacs.

Use common areas to minimize the use of shared common rear and side yard fence lines. This will provide large and spacious private areas in which residents shall have a clearly defined responsibility for yard and landscape maintenance.

All unit's living walls shall be set back from streets a minimum of 25 feet and different garage configurations, ranging from side, front and side entry, shall create variety in garage massing and set backs from the street. The overall effect will be a pleasing variation in housing set backs from the street that varies from one house to another.

Split face CMU shall be used as a fencing material when combined with accent colors shall provide an attractive perimeter appearance of the overall site and in the private yard areas.

The new and future housing shall have five distinct floor plans with two distinct elevation styles, one floor plan will be handicapped. This will create nine unique architectural building appearances. Through the use of mirrored plans and three separate color schemes per building a total of 54 separate building appearances shall be possible. All units shall be designed, detailed and constructed to exceed the National Energy Star Standards. The two different but complementary exterior elevations shall be the Mission and Mediterranean styles. Although these two styles are very complimentary, the subtle and distinct differences of massing and

fenestration between these designs shall enhance the diversity and private sector like appeal of the overall community.

Elestomeric light color stucco system with decorative exterior accent trim shall be used extensively throughout the buildings. These accent treatments shall create an engaging exterior appearance by creating textural and color diversity across the front, sides and rear exterior facades of the buildings and shall help to emphasize the variety, individuality and identity of each building type. The exterior trim and fenestration accents shall provide and unify elements that help define the character of the neighborhood while providing individual identity to each housing unit.

The use of various light multi-colored concrete tile roof-massing elements, such as, gables, hips and dormers shall be carefully integrated into the design of each building. The roof shall vary on different roof-massing elements from 5"/12" to 6"/12" slopes on each unit. These design elements shall be employed to maximize variety in appearance. This will be accomplished by the use of asymmetrical building elevations that will be engaging and provide the project with dynamic streetscape.

All exterior walls, at all units shall have 2 x 6 wood stud perimeter walls. This will provide thermal insulation value of R-19 and sound attenuation properties for all units.

Each unit entrance shall be protected with a covered entry porch. Raised entry doors shall provide variety, a more dramatic entrance and an upscale private sector like appeal, to the units. A raised panel entry door shall have feature lites, a sidelite and transom windows shall add to the visual interest of the front facades. The use of Clearstory windows over the main entry doors, shall give these foyers an attractive focal element and additional natural lighting. Entrances shall be accentuated with raised-height rooflines for added emphasis from the street.

Window glazing shall have a low-E coating. All windows and patio doors shall be provided with decorative window grids. The decorative window grids will enhance the exterior appearance of the units and add an elegant attractive visual element to the facades of the units.

A spacious entry foyer shall open to the living room area and shall provide access and circulation without compromising the furnishing arrangement of the main living space. All foyers shall have a convenient coat closet and provide a spacious well-lit space to greet the neighbors and guests.

The kitchens shall be designed around an efficient work triangle to facilitate food preparation. All kitchens shall have a generously sized pantries contiguous with the work triangle for additional food storage and occupant convenience. The kitchens shall be arranged to allow for views into the back yards and the adjacent living/dining rooms. Each kitchen will be provided with a full height ceramic tile backsplash under the upper cabinets and a full height stainless steel backsplash behind the range. Each unit type shall have a modern free-standing kitchen work island. The work island shall contain the sink and dishwasher functions as part of the efficient work triangle of the overall kitchen layout. These islands shall feature a raised wrap-around breakfast/ serving counter. The islands shall be carefully located to provide open views and service access to and from all parts of the main living areas and also to the exterior. A dedicated recessed ceiling light shall illuminate all work surfaces at the island.

- *Wall cabinet space should be more than 149% of AF Family Housing Requirement.*

- *Base cabinet space should be more than 150% of AF Family Housing Requirement.*

- *Drawer space should be 180% of Air Force Family Housing Requirement. This additional storage shall be provided for increased convenience, utility and practically of units.*

- *Counter space should be 180% of Air Force Family Housing Requirement. This extra counter space shall facilitate food preparation and provide additional convenience to the residents.*

The open plan design of each unit type shall provide very flexible and easily furnished living, dining and family spaces. These spaces shall be well defined yet open to each other for maximum view lengths and space borrowing.

The family rooms shall be contiguous with the kitchens in all units. This combination of spaces forms the core of today's casual family activities and gatherings. Large patio doors and windows shall be provided to ensure plenty of light and ventilation. Ceramic tile floors shall be provided in all family rooms for durability, ease of maintenance and long-lasting beauty.

Each unit shall be provided with a separate utility room for laundry tasks. Enclosed, wall-hung cabinets shall be provided above the washer/dryer for storage of laundry and related items. A shelf and rod combination shall be also included in each laundry room for hanging clothes. Built-in ironing boards and folding counters shall be provided in all units. All utility rooms shall be provided with a window for natural lighting and ventilation. Ceramic tile floors shall be provided for easy maintenance.

Large walk-in closets shall be provided for all master bedrooms. The closet space should be an average of 386% of minimum AF Military Family Housing Requirement. Secondary bedroom closets shall be provide for maximum acoustical separation from adjacent rooms. A shelf and double hanging rod section shall be provided on each side of each master bedroom closet. This amenity maximizes the usability of the closets and provides residents with a custom home feature.

Secondary bedroom closets shall be located so that a maximum acoustical separation from adjacent rooms is created. Closet doors shall be located away from walls to allow for additional furniture placement.

All linen, broom and pantry closets shall be conveniently located near their point of use.

The living/dining room spaces in all units shall have vaulted ceilings; these vaulted ceilings provide an open feeling and spatial variety within the residences. Ceiling heights in all other rooms shall be set at 9 feet high. The living/dining room shall be designed as a large open "great room" for a spacious feeling and to maximize furniture arrangement flexibility. Large operable windows in this room will contribute natural lighting, cross ventilation and views to the enclosed private yards. 42 inch-high half-walls with built-in bookcases shall be provided. These half-walls allow views into the adjacent spaces and additional storage/display space for the residents.

All master bathrooms shall be provided with two lavatories and solid surface countertops. Ceramic tile accents will be on all walls around the vanity cabinets. Two build-in medicine cabinets and full-height mirrors shall be provided. Ceramic tile floors and solid surface tub/shower surrounds shall be provided.

Each unit type shall have a built-in computer "technical center" countertop located conveniently for the entire family to use. The tech centers shall be furnished with two electrical outlets, a CAT V outlet and a phone outlet for the residents' complete computer needs.

The family bathrooms shall be centrally located along the main circulation path for ease of access from all main living spaces. These bathrooms shall feature a "compartmented" design for added flexibility of use. Lavatories shall be integral with the solid surface countertops and have ceramic tile accent walls at each end of the lavatory cabinet. Ceramic tile floors and solid surface tub/shower surrounds shall be provided in all family bathrooms.

The interior storage square footage should be 192% of the AFHG requirement. The exterior storage area should be provided at 185% of the AFHG minimum recommendations. Both interior and exterior storage areas shall be provided with a convenient outlet. 12-inch deep plywood shelves shall be placed along one wall in each area for increased storage capacity. Interior bulk storage shall be located in a separate room in all units rather than as an extension of the utility room.

All living/dining rooms and bedrooms shall be provided with ceiling fans for added ventilation and occupant comfort. All living/dining rooms shall be provided with two ceiling fans, which provide greater freedom and choice of furniture groupings.

All patios shall be fully covered for maximum shading, protection from the elements and for extended year-round use. Each patio shall be accessed through a 6 foot wide fully glazed French doors. The patios shall be sized to provide a fully integrated "outdoor" room and to facilitate a wide range of family activities.

All units shall have a 3 foot wide and 4 inch thick concrete apron around the entire perimeter.

Each unit shall have an exterior enclosed trash area conveniently located for ease of access yet screened from the street. Enclosed trash areas shall be sized to accommodate a wheeled garbage container and a recycling bin. Two 3-foot wide wrought-iron gates shall be provided for ease of removing and replacing the containers as needed.

The mechanical closets at all units shall be designed for easy access and service by the occupants. Water heaters and a minimum of 6 square feet for a future water softening system are included in these closets. Double doors shall be provided for ease of routine maintenance tasks.

The two-car garages shall be integrated into the design in order to reduce the visual impact of the garage from the streetscape. All garage doors shall have feature glazing lights in a variety of patterns. Garage personnel doors shall have half-lights for easy access to the enclosed trash storage areas and side yards. All garages shall have automatic garage door openers with two exterior control pads for the resident's convenience.

2. ACC ARCHITECTURAL STANDARDS SYNOPSIS

2.A Policy Statement

"The special character of defense installations dictates compatibility over personal style. The limited size and function of Air Combat Command (ACC) bases cannot accept the diverse opinions of the many design professionals without becoming cluttered and unsettled. In this context "good design" is defined as design that contributes to the overall harmony of the base rather than design that attracts individual attention. Good examples of where ACC design goals should lead are college campuses and corporate office parks. Because we do not want monotony, every building does not need to be the same, but some common architectural element or theme should tie all buildings together. Responsible design will achieve this goal.

Use a simple approach to locate facilities. Facilities having similar functions should be located in the same vicinity on un-congested

sites, but do not permit parking to dominate. Use indigenous, low maintenance landscape material. Relate building forms to each other and use low maintenance materials. Do not paint new buildings. Use materials that do not require painting during their lifecycle. Use neutral colors such as gray and brown."

ACC PUBLICATION SUPPLEMENTS: Air Combat Command (ACC) Supplements to Air Force Publications. Can be obtained from Internet web site http://www.acc.af.mil/. Then follow the link to the Library Page and then the link to ACC publications.

2.B Goals

The following goals have guided the above ACC policy and should also guide all levels of design at Holloman:

- *Site Conditions* - Provide site conditions and building forms appropriate to any new, future or existing buildings.

- ***Site Drainage*** – **Built up the site 12" to 24" above surrounding grade to promote positive drainage away from building foundation**.

- *Low Maintenance* - Use permanent low maintenance exteriors that are compatible with ACC bases and their natural and manmade environments.
- *Environmental* - Design facilities in ways to enhance environmental quality and minimize consumption of natural resources.
- *Layouts* - Provide functional layouts that completely satisfy user needs.
- *Cost* - Reduce lifecycle costs.
- *Labor* - Reduce labor-intensive maintenance procedures.
- *Approval* - Obtain user approval of design concept layout prior to pre design conferences in order to prevent costly changes during final design, contracting and construction. This is normally done through a Customer Concept Document prior to preparation of programming documents.

While the guidelines presented in the following pages are specific to Holloman Air Force Base, the overall design philosophy of the ACC, stated above, is the foundation upon which these specific recommendations are based.

3. BUILDING SCALE / HEIGHT /MASSING

3.A Current Conditions

As might be expected, building scale and massing vary greatly at Holloman depending on building function and zone.

In Zone 1, hangars and maintenance buildings are required to provide large open work bays and accommodate equipment. Large-scale warehouse buildings are in many cases accompanied by one or two story administrative support structures. Zone 1 exhibits the fewest consistencies in scale and massing due to the purely utilitarian nature of the zone.

Zone 2 structures tend to be one or two stories, with some three-story structures. Generally compact in plan and rectangular in shape, these buildings reflect their administrative, maintenance, security, engineer, and industrial functions.

Zone 3 community support facilities range from three story dormitories to club facilities, a fitness center and recreation fields, schools, and the base exchange and commissary.

Zone 3, though lacking the overall consistency in scale and massing of Zone 2, does have individual pockets that positively

respond to these issues. The dormitory area between Rhode Island and Delaware Avenues concentrates similarly sized and scaled buildings, creating a cohesive architectural grouping. Likewise the Youth Center (Building 647) and Child Development Center (Building 650) are complementary in scale and massing.

Zone 4, the Military Family Housing area at Holloman, consists exclusively of one and two story structures, residential in both character and scale. Massing and scale-wise this is the most consistent zone on the base.

YOUTH CENTER AND CHILD DEVELOPMENT CENTER

3.B General Requirements

Building heights at Holloman will be reviewed on a case-by-case basis. Specific program needs may define or restrict the number of stories. In general buildings shall be one or two stories in height.

Building massing should generally be simple and economical. Avoid uneconomical shapes such as curves, diagonals and long rectangles unless specifically warranted by site or building function. If functionally appropriate the clustering of buildings and building masses can soften the harsh climatic conditions by providing windbreaks and shade on exposed facades.

Setback distances on primary and secondary streets shall comply with the latest anti-terrorism/force protection (AT/FP) guidelines. Parking lot setback distances from existing buildings will also comply with the AT/FP guidance.

If programmatically justified, site interior courtyards or clustered building arrangements to create naturally protected exterior courtyard spaces. For additional information see "Courtyards/Shelters" in Architectural Standards, Part II, Section 8.

Site buildings supporting a common function (such as dormitories) in proximity to each other. In addition to sharing common infrastructure, the massing, scale, materials and details will be used to link the buildings aesthetically.

Residential structures in Zone 4 shall be limited to two stories in height. Setback distance from the street will be consistent within individual housing groups.

BUILDING 578, THE DYNCORP HANGAR AND BUILDING 577, BASE OPERATIONS – DIFFERENT SCALES BUT COMPATIBLE DESIGN

3.C Variations

As mentioned, due to the utilitarian nature of the structures in Zone 1, compatibility with adjacent structures is problematic. Structures of conflicting scales shall be visually connected by design elements such as similar masonry base treatment, banding, coloration, etc. The Dyncorp Hangar, Building #578, and the Base Operations Building, #577, are architecturally compatible, despite scale differences, through the use of common base treatments, materials, detailing and roof slope.

4. ROOFS

4.A Current Conditions

Roof forms and materials vary widely at Holloman. Flat roofs, both built-up and membrane, occur base-wide. These type of roofs shall not be used unless it is demonstrated that a standing seam pitched roof cannot be used (i.e. a small addition to an existing building with a flat roof would justify adding another flat roof). Curved and low-slope metal roofs, some standing seam, some with prefabricated panels, can be seen on hangars and service buildings. Higher-sloped standing seam metal roofs occur base wide. Sloped roofs appear in shades of brown, tan and white. Typically, housing is roofed with low-sloped gravel or fiberglass shingles.

The most positive trends, and the Holloman AFB standard, on the base and perhaps the most unifying are the use of sloped, brown standing seam metal roofing on buildings in zones 1, 2, and 3; and the use of fiberglass shingles on the sloped roofs of the housing units. While flat roofs are

A SUCCESSFUL EXAMPLE OF A SLOPED STANDING SEAM METAL ROOF WITH A PRONOUNCED OVERHANG

well represented, the buildings using sloped roofs provide the beginning of a stronger overall "base character". ACC and Base policy dictates the use of sloped roofs and forms.

4.B General Requirements

Roofs at Holloman shall be of gable or hipped design, sloped a minimum of 3:12 and be of pre-finished standing seam metal or fiberglass shingles in housing. 1-1/2:12 slope is allowable on very long span metal roofs. Flat roofs shall not be used unless it is demonstrated that a standing seam pitched roof cannot be used (i.e. a small addition to an existing building with a flat roof would justify adding another flat roof, or a renovation of a flat roof building where conversion to a pitched roof is outside of the project budget). If the project does not allow for a pitched roof conversion, designers are encouraged to use strategically placed sloped roof elements to punctuate key building points (entrances for example) and to screen portions of the flat roof where possible. The Base Architect must approve the use of all low slope or flat roofed buildings prior to design start. These will normally be disapproved unless there is significant justification for their use in a project.

Roof overhangs, trellis elements, and recessed windows are encouraged for sun control. Solar gain can be cut substantially, especially at windows. Pronounced fascias are also encouraged, particularly on metal roofs. Both the fascia and soffit shall be of the same material as the roofing. Carefully proportioned fascias can positively affect scale and massing, particularly in larger buildings.

Vents and piping forced to penetrate a roof shall be treated as trim material and painted to match the roof. If possible such elements will be located on areas out of view.

Mechanical equipment shall not be located on roofs. All ground mounted mechanical and electrical equipment shall have a factory applied finish meeting HAFB color standards.

Due to local soil conditions, water control is critical. Gutters, preferably concealed, are mandatory on all sloped-roof buildings to control storm water runoff.

Internal roof drains are discouraged. Downspout placement, as with any other architectural element, shall be carefully considered and well integrated with the overall design. Collected water shall be channeled a *minimum* of 10' from the building perimeter to the base storm water drainage system. A three-foot wide concrete slab shall be placed around the perimeter of each new building.

All fascias, gutter and roof trim shall be made of pre-finished metal and be designed to prevent deformation or ripples from expansion and contraction.

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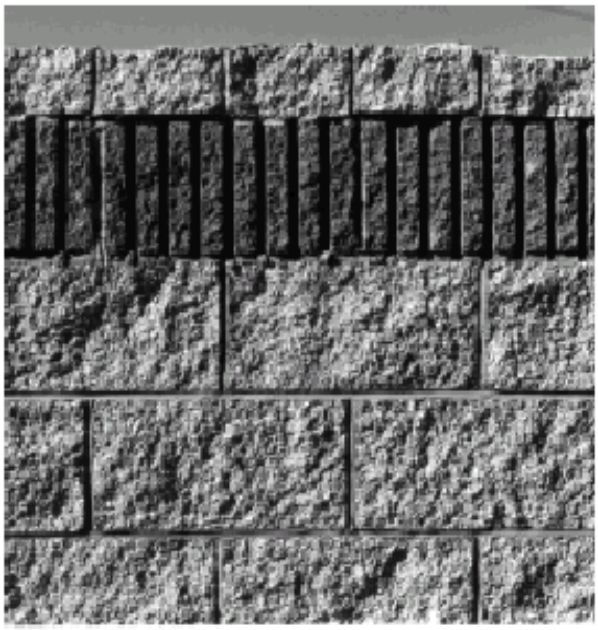
DOWNSPOUT WELL-INTEGRATED WITH FACADE. RUNOFF CHANNELS INTO A CATCH BASIN.

4.C Approved Materials and Treatments

Zone 1
Standing seam metal roofing only. All roofs shall have a minimum 3:12 slope.
Manufacturer: Metal Building Components, Inc.
Color: Sahara Tan (Kynar Finish)

Zones 2 and 3
Standing seam metal roofing only. All roofs shall have a minimum 3:12 slope.
Manufacturer: Lilly Industries, Inc.
Color: Medium Bronze (Kynar Finish)
(Equal to Sherwin Williams - 2028)
Zone 4
Fiberglass shingles only. All roofs shall have a minimum of 3:12 slope.
Manufacturer: Owens Corning, AEP
Color: Autumn Brown, Desert Tan



TWO-COLOR SPLIT FACED AND RIBBED CONCRETE BLOCK COMBINATION

5. EXTERIOR WALLS

5.A Current Conditions

A wide variety of exterior wall types currently exist at Holloman AFB. In zones 1, 2, and 3, various masonry treatments are common. Brick, split face and ribbed concrete-masonry-unit (CMU), painted CMU, aggregate panels and limited pre-cast concrete are all present. In addition to masonry, in Zone 1, various metal wall systems are present. In Zone 4, brick, painted CMU, stucco and even wood siding are used as exterior wall finishes. The majority of walls in all zones are various shades of brown and tan.

The most positive exterior wall treatment in zones 1, 2, and 3 is the split-face and ribbed CMU evident in various combinations in many newer buildings. The DynCorp Hangar Building #578 and Base Operations Building #577 are excellent examples of a mix of acceptable exterior wall finishes. The hangar building combines approved metal panels on higher wall surfaces with split face CMU on lower walls to compliment the adjacent administrative support building, also of split face CMU. The Westerner Dining Hall, building #812, and the new Fitness and Sports Center, building #588, also represents a successful application of split face CMU. Zone 4 exhibits a mix of exterior finishes and would benefit greatly from a cohesive exterior wall finish palette.

5.B General Requirements

Masonry walls shall be built of integrally colored split-face CMU unless prior approval from the Base Architect is obtained. All CMU should be manufactured with additives to discourage efflorescence. Likewise all mortar shall contain similar admixtures. CMU variations within a single building shall be limited to a split face primary block with one type and color of complimentary accent block.

Articulation of walls shall occur through changes in the wall plane and variations in texture and color within the block palette, not through the use of paint or material change. Masonry articulation can also successfully aid in identifying building entry in appropriate situations. All exterior CMU walls that terminate above or below the building's roof height shall have metal cap flashing. All CMU wall assemblies shall achieve a minimum R-value of 19 for thermal performance.

Exposed aggregate or pre-cast concrete panels may be acceptable in certain base locations or when renovating a building with similar construction. These are limited primarily to renovation applications and require approval from Base Architect and the ACC Command Architect.

If, in larger scale structures such as hangars and industrial buildings, function and budget dictate the use of pre-engineered metal buildings, a masonry "base" shall be used. The height of the masonry base may vary from 3 feet to 10 feet to blend in with surrounding buildings and offer the most appealing appearance. The base shall match the color, material and height of any adjacent administrative or support buildings. Metal wall panels may be used above this and shall match the metal roof of the structure. Metal wall panels, when used, shall be factory pre-finished aluminum or galvanized steel with a 20 year guarantee against fading. Use of metal siding requires review and approval by the Base Architect and ACC Command Architect.

When upgrading existing CMU or frame structures, stucco, exterior insulation and finish systems (EIFS) and limited exposed aggregate panels are acceptable options. In these instances a waiver is required from the Base Architect and ACC Command Architect.

New construction in Zone 4 shall incorporate stucco as the primary exterior wall finish. Stucco should never be painted on new facilities. EIFS, synthetic stucco, may be used for renovations in Zone 4 but require review and approval by the Base Architect and the ACC Command Architect. EIFS will not be used for new military family housing.

5.C Unacceptable Applications

New buildings shall not require exterior painting. Standard CMU, stucco, metal siding, EIFS, etc. will not be used in zones 1, 2, and 3. Exterior wall attachments such as downspouts, conduit, switches, bells, etc. will not be emphasized by painting. These shall be painted or factory finished to match wall color.

5.D Approved Materials and Treatments

Zones 1, 2, & 3
Split Face CMU
Manufacturer: Del Norte Masonry
Colors: Holloman Red, Holloman Buff

RENOVATED DORMITORY WITH EXPOSED AGGREGATE HORIZONTAL BANDS. NOTE THE SLOPED ROOF, WHICH PUNCTUATES THE DORMITORY STAIRS.

Metal Wall Panels (Extremely Large Buildings) Manufacturer: Metal Building Components, Inc.
Colors: Sahara Tan, Medium Brown (Kynar Finish)

Exterior Insulation and Finish System
(Renovation only)

Manufacturer and color: As selected by the Base Architect.

Painted Exterior Doors
Paint Color: Medium Brown
(Glidden 78-64, could be matched with Sherwin Williams)

Painted Wall Surfaces
Paint Color: As approved by the Base Architect.

INAPPROPRIATE USE OF METAL SIDING

Zone 4
Stucco
Manufacturer and color: As selected by the Base Architect. The three-coat system with a synthetic final coat is required.

Exterior Insulation and Finish System
(Renovation only)
Manufacturer and color: As selected by the Base Architect.

Painted Wall Surfaces
Manufacturer: Welborne
Colors: Q5-6P, Q6-46P, Q5-11P, Q4-37P

Painted Doors, Louvers, Trim
Color: As approved by the Base Architect.

6. WINDOWS

6.A Current Conditions

As with roof and exterior wall materials, window types vary greatly over Holloman AFB. In Zones 1 and 2 large steel-framed industrial style windows may be found on some of the hangar and maintenance structures. Immediately adjacent may be administrative structures with insulated fixed glass units in punched masonry openings. Operable windows; horizontal sliders, single hung, etc., are found in the Zone 4 residential structures. Both building age and function have contributed to the window variation at Holloman. Current base policy shall be double glazed, thermally broken metal-framed units, dark bronze anodized. Recessed window panes are common due to the harsh solar conditions. In Zone 4 the windows are predominantly operable dark brown or bronze metal framed units.

6.B General Requirements

Windows at Holloman shall have bronze tinted double-glazing set in thermally broken, anodized aluminum frames. Facilities in high noise areas shall have levels of noise attenuation provided in design IAW the Air Installation Compatible Use Zone (AICUZ) Program Manager Guide, AFH 32-7064. Toilet windows shall be frosted glass.

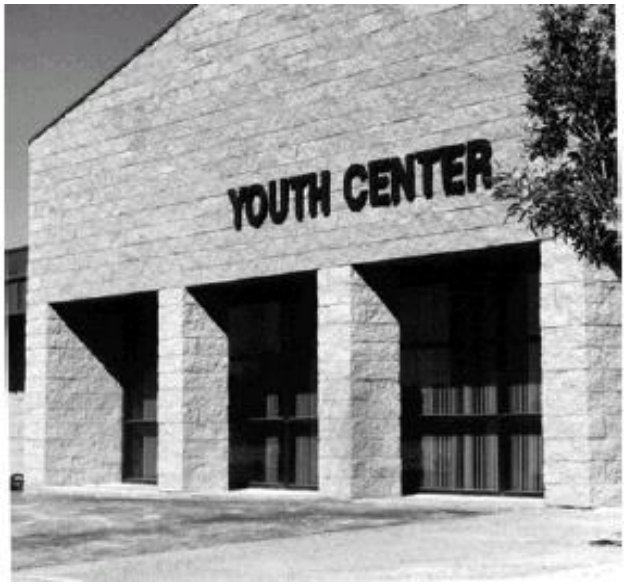
AFH: AIR FORCE HANDBOOK. Can be obtained from Internet web site http://afpubs.hq.af.mil/orgs.asp?type=pubs

The Base is flexible regarding the amount of glazing used on a building. Limited glass area in a punched opening vocabulary is encouraged base-wide. Where appropriate limited window groupings, glazed entry doors with sidelights and other variations are acceptable. Large curtain wall applications however are not acceptable in Holloman's harsh climate. Limited operable windows are desirable in Zones 1, 2, & 3.

Operable windows are mandatory in Zone 4. When possible windows should be recessed for solar control. Solar control is mandatory on *all* south and west facing windows. If window blinds are used they shall not be of reflective metal. Clerestory windows, when functionally justified, are acceptable.

Clerestory windows shall be oriented to minimize heat gain. Skylight applications are not desirable and shall require a waiver from the Base Architect and ACC Command Architect.

Replacement windows should match the size of the window being replaced. Unless otherwise justified, replacement windows should always adhere to the above recommendations for new windows. Any variation shall require a waiver from the Base Architect and the ACC Command Architect.



RECESSED STOREFRONT SYSTEM (TOP) AND WINDOWS (BOTTOM) AT YOUTH CENTER

RECESSED STOREFRONT ENTRY GLAZING

Main entry doors in Zones 1, 2, and 3 shall be glazed storefront in approved colors. Secondary entry and exit doors and frames shall be painted metal. Exterior doors in Zone 4 shall be painted insulated metal.

6.C Unacceptable Applications

Window design and selection shall consider function and maintenance. Window materials that require painting or other frequent maintenance are not acceptable. Flush window applications on facades subject to harsh sun shall be avoided. Solar shading film shall not be used as a solar control option.

6.D Approved Materials and Treatments

Zone 1
Hangar Doors:
Manufacturer: Metal Building Components, Inc.
Colors: Sahara Tan

Exterior Painted Doors:
Colors: Medium Brown, Medium Bronze

Windows/Glazing:
Manufacturer: Kawneer Co., Inc.
Colors: Frame: Bronze
Glazing: Bronze, triple glazed

Zones 2 and 3
Exterior Painted Doors:
Colors: Medium Brown, Medium Bronze

Windows/Glazing/Storefront Systems:
Manufacturer: Kawneer Co., Inc.
Colors: Frame: Bronze
Glazing: Bronze, double-glazed

Zone 4
Exterior Painted Doors:
Colors: As approved by base Civil Engineering.

Windows/Glazing:
Manufacturer: As approved by base Civil Engineering.
Colors: #40 bronze

7. SITE WALLS AND FENCES

7.A Current Conditions

Site walls and fences of various types are used extensively at Holloman. Functionally these fences and walls serve as property and security boundaries, visual screens and wind breaks. Materials include split face and ribbed CMU in various combinations, PVC, chain link and basket weave wood fences.

Within Zones 1, 2, and 3 some consistency exists due to the use of split face and ribbed CMU for the majority of the site walls and fences. This material and the horizontal emphasis of the fences and walls blends well with the character of the desert and reflect the material palette of much of the architecture. This adds to the base the type of visual harmony sought in overall ACC design policy. Within Zone 4 however, the chaotic mix of PVC, chain link and concrete block does not support a cohesive visual character.

TYPICAL MASONRY SITE/SCREEN WALL

The current fence replacement policy was implemented as a major first step in eliminating the problem and elevating the visual character of the zone.

7.B General Requirements

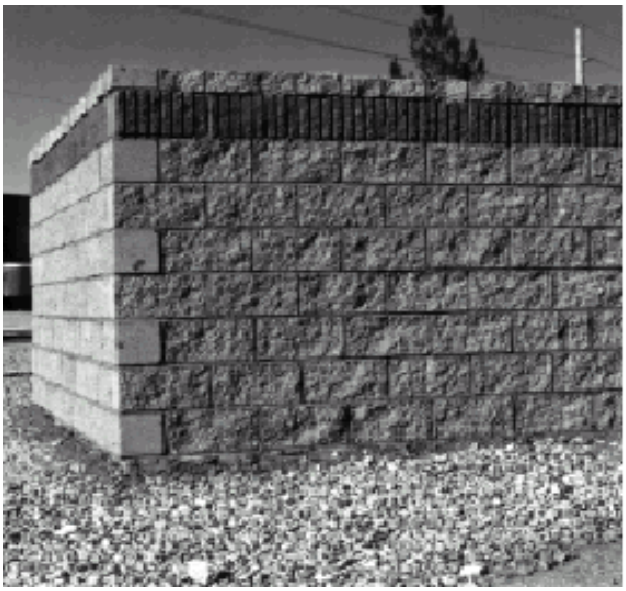
Fences and site walls shall continue to be used at Holloman as boundary elements, visual screens and wind breaks. In Zones 1 and 2, wall and fences shall be constructed of split-faced block, in a maximum of two colors, with a solid cap course top. When used in conjunction with a new building, the material and design shall complement the building.

Any decoration on site walls and fences shall be achieved through variations in the wall plane and the use of perforated block or open voids in the block coursing at selected locations. Undulation and height variation is encouraged for stability and for the creation and definition of green spaces where appropriate. The horizontal emphasis shall remain the prominent image.

In Zone 4, fences and site walls at main boundary areas (street edges, project boundaries, etc.) shall follow the above recommendations. Fences separating individual yards shall be the base-standard white PVC. Should the need exist to fully enclose a rear yard, base-standard chain link fencing supplied by the tenant is allowed.

Provide two-sided CMU enclosures for all dumpsters. Enclosures shall be designed following masonry site wall guidelines. Orient open end of enclosure away from building entrances and primary views and include a concrete apron. Ensure standoff compliance with latest AT/FP guidance in siting enclosures. In Zone 4, dumpsters shall be located away from front yards.

STANDARD PVC FENCING IN ZONE 3



TYPICAL DUMPSTER ENCLOSURE

Fences, site walls, dumpsters, etc. shall be located in accordance with UFC 4-010-01. Ensure that the visual line of sight for motorists is not obstructed.

7.C Approved Materials and Treatments

All Zones
Split Face Concrete Masonry Units
Manufacturer: Del Norte Masonry
Colors: Holloman Red, Holloman Buff

Zone 3
PVC Fencing:
Contact Base Civil Engineering for product information.

Chain link:
Contact Base Civil Engineering for product information.

8. COURTYARDS, SHELTERS

8.A Current Conditions

With over 300 sunshine days a year, Holloman is a base where you not only welcome the sun; you have to be protected from it. There are outdoor courtyards and shelters that can be found at various locations on the base serving many facilities and areas. Seven new picnic shelters were constructed at Steinhoff Park, phase one of the park expansion plan. Shelters are also a prominent part of the plaza design in the dormitory complex. The Child Development Center (Building 650) has a walled interior reading courtyard protected from sun and the wind. While these shelters are beneficial, there are not enough of them throughout the base. Some locations warranting shelters such as playgrounds and parks are, unfortunately, without areas to escape the elements.

A need exists at Holloman for more exterior courtyard and shelter spaces, protected from the elements, for staff break areas, picnic shelters, shaded playground observation, etc.

8.B General Recommendations

Protected outdoor employee break areas, picnic shelters, playground and park shelters, etc. shall be included, when justified by occupancy, in new construction, improvement and renovation projects. Shelters shall be included in all new playground and park designs.

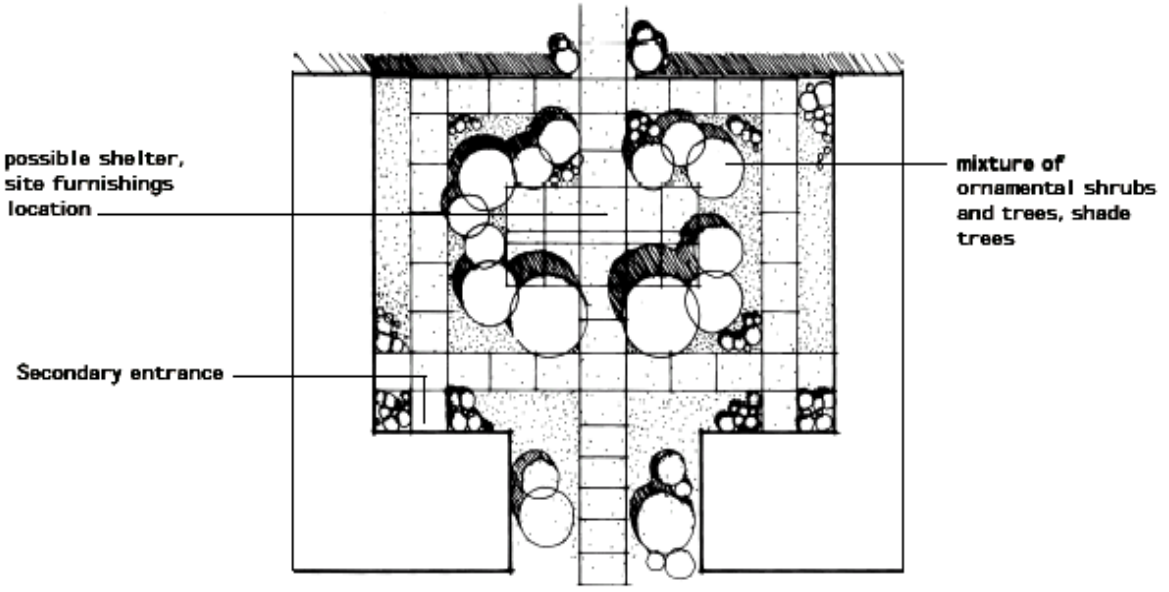
Outdoor shelters and courtyards should generally conform to the architectural guidelines of the Zone in which they occur. If serving a specific building, materials used should match the building being served.

Orient shelters and courtyards to take advantage of climatic conditions, such as seasonal sun, shade, and breezes. Consider the effects of blowing dust and debris when building shelters to minimize the trapping and settling of trash and weeds.

Provide site furnishings, lighting and landscaping as necessary to both support the function and create an inviting gathering zone.

8.C Approved Products/Treatments

Refer to previous applicable sections for building materials, landscaping, site furnishings, etc.



RECOMMENDED COURTYARD LANDSCAPE TREATMENT

(TOP) INAPPROPRIATE SHELTER DESIGN – DOES NOT REFLECT CHARACTER OR MATERIALS OF ADJACENT BUILDING
(BOTTOM) SUCCESSFUL SHELTER AT DORMITORY COMPLEX – SPLIT FACED CMU MATCHES MATERIAL AND PROPORTION OF ADJACENT DORMITORIES

9. SITE FURNISHINGS

9.A Current Conditions

While site furnishings and related pedestrian amenities are present at Holloman, applications are largely facility specific rather than adhering to a base wide standard.

9.B General Recommendations

Site furnishings shall be considered in all new construction, renovation and street improvement projects. When site furnishings are functionally warranted, the furnishing selections shall comply with the base standard in order to reinforce the overall visual harmony.

Consider climatic conditions in selection and placement of all site furnishings. Solar factors such as direct heat gain on metal components (especially play equipment), ultraviolet degradation of plastics and shade for users shall be addressed. Wind protection, especially during months characterized by strong prevailing winds should also be considered. The prevailing spring winds come out of the west. When possible take advantage of shelters, landscaping and building mass for solar and wind protection.

Play equipment selection and placement shall consider age groups ranging from pre-school to teen. Place equipment away from vehicular traffic paths in a location easily supervised.

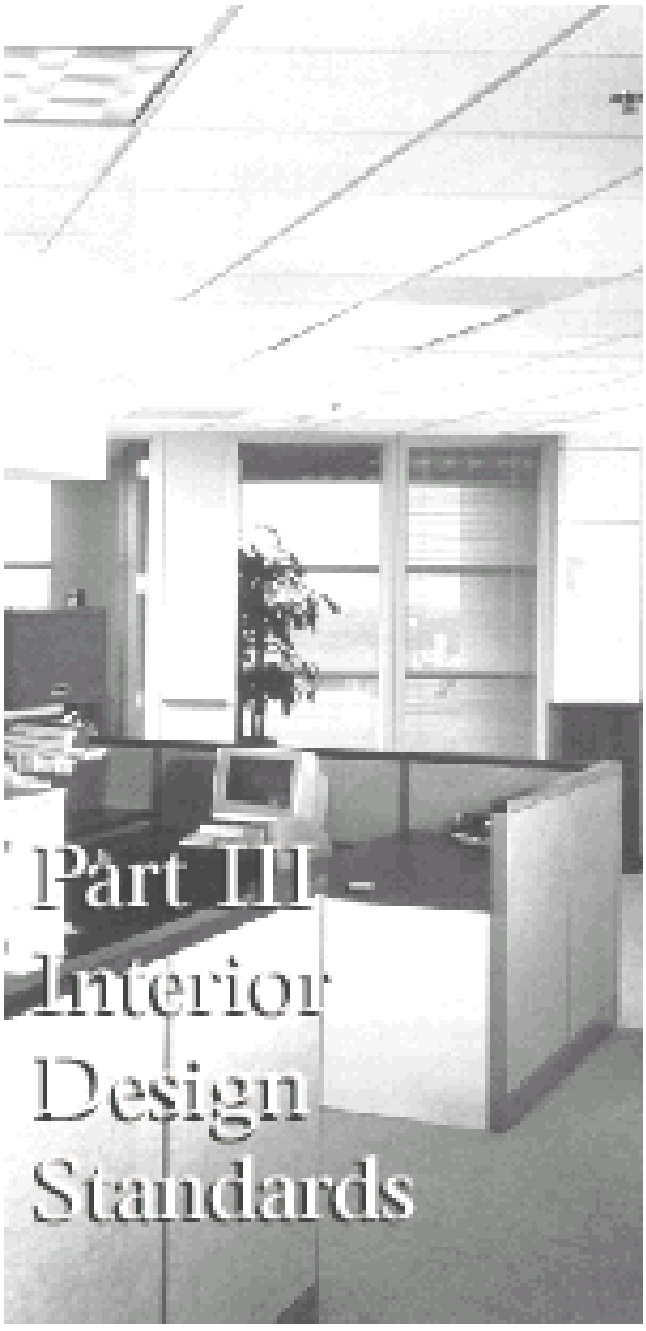
9.C Approved Products/Treatments

Benches:
Victor Stanley Inc., Classic Series Model No. CR-38

Trash Receptacles:
Victor Stanley, Inc., Model S-35 3/8" solid steel bars.

Bike Racks:
Madrax, Heavy Duty Winder Plus (WP158-9-SG-P)

Play Equipment:
Game Time, Fort Payne, Alabama
Little Tykes, Farmington, Missouri


Part III -
Interior
Design
Standards

1. ACC INTERIOR DESIGN POLICY

ACC interior design standards are developed around an understanding of the elements and principles of design and of how the industry works, not around personal likes and dislikes.

2. INTERIOR DESIGN STANDARDS

ACC standards differentiate based on whether a finish will be permanent or non-permanent. The differentiation is necessary due to color palette changes each year.

2. A Permanent Finishes

Permanent finishes are generally the hard surface structural interior design (SID) finishes that will last 15 to 20 years and whose removal and re-installation is a major disruption to the facility. Such items as vinyl composition tile (VCT), ceramic and other surface tile, plastic laminates, toilet partitions, lockers, window blinds, all modular or systems furniture panels, work surfaces, flipper doors, etc. are considered permanent finishes. Generally permanent finishes need to be a color that will not become dated in a few years. Command standards require that all permanent finishes be either brown-tone or gray-toned neutrals. These neutral shades can vary from very light (such as an off-white relating to the particular color tone) to a mid-range neutral of this same shade.

2. B Non-Permanent Finishes

Carpet, paint, vinyl wall covering, upholstery, artwork, etc. are considered non-permanent finishes. Non-permanent finishes will last from five to seven years under most conditions. Command standards allow non-permanent finishes to be any coloration appropriate to the facility. Most often these finishes will be in mid-range colorations. Very seldom would there be a use for pastel or very bright colors in facilities. However, primary colors of red, yellow, blue and green may be used in youth centers, child care centers and bowling centers. While non-permanent finishes are allowed in various colors, in office and other work areas it is highly recommended that the vinyl wall-covering or other painted wall surfaces be kept in neutral coloration. In other words, develop a neutral shell for the interior space with only the carpet, upholstery and artwork providing the color accent.

2.C General Recommendations for Finishes and Treatments

Vinyl Wall covering - Should be type II in most applications. Type I has limited use in most ACC facilities. A vertical texture will help hide seaming.

Paint - Use a low-sheen latex enamel for all painted surfaces. Use a semi-gloss finish for trim paint.

Laminates - Laminate surfaces are much more maintainable if the laminate has a flecked, speckled, mottled or granite look. Soiling or water spotting is not nearly so visible on these surfaces.

Ceilings - In almost all facilities ceilings (whether painted gypsum board or acoustical ceiling tile) are to be off-white to coordinate with the color tone of the walls. Textured ceiling tiles in a two-foot square with a regular edge are recommended.

Wainscot and Chair Rail - Wainscot is not recommended in most areas. Dark paneled wainscot has the visual effect of reducing the size of small office spaces. In long hallways wood panel wainscot has a railroading effect. A type II heavy-duty vinyl wall covering will have a better effect. If paneling is required, cover one accent wall floor to ceiling. The purpose of chair railing is to protect wall surfaces from being marred by chair backs. Therefore, the chair back height must be considered to properly locate the chair rail. It may be stained or painted

to coordinate with other woodwork or doors. Wainscot and chair rail shall be no more than 42" high in corridors. Heavy vinyl bumper guards may also be used to protect walls in corridors where needed. They, too, should be in coordinating neutrals.

Vinyl/Rubber Base and Carpet Base - Use vinyl/rubber base in floor areas where the floor surface is vinyl composition tile (VCT) or rubber tile. Base is to be in a coordinating neutral to the floor surface, as near the same shade as possible. Do not use a dark color or accent color for the base. Use a 4" carpet base capped with a dark neutral vinyl/rubber carpet cap in carpeted areas. Use the same carpet for the base as meets the wall in the case of borders. When carpet tile is used it will be necessary to use a vinyl/rubber base. Choose a neutral that will most closely relate to the carpet coloration or wall coloration. With carpet tile, a straight base must be used (one without a cove foot) and installed first with the carpet tile butted up to it. In ceramic tile areas, if a base is used it will be a coordinating ceramic tile base.

Ceramic Tile - Use a mottled, flecked, or specked floor tile if at all possible. Also be sure to use a dark tone grout, which coordinates with the floor tile to avoid a stained or soiled appearance. Tile banding accents or patterns are approved for walls and floors provided the accent is another neutral shade, which coordinates with the dominant tile color.

Doors and Doorframes - Depending on the quality of the doors, they may either be stained or painted. If painted, they may either be painted a color related to the wall color or an accent color of mid-range hue. Hollow metal doorframes are best painted a color close to the wall color or a shade or two darker.

Window Blinds - Metal or vinyl blinds may be horizontal or vertical and are best in off-white or light neutrals. In no case should blinds be of a reflective metallic finish. Dust is not as visible on the light colors as on the dark colors, and vertical blinds collect less dust than horizontal ones and are encouraged. Dark blinds that match the anodized finish of the window frames are acceptable, provided the windows are of reflective glass. If the windows are not of reflective glass, dark blinds will radiate a great deal of heat into the building rather than reflecting it as light or off-white blinds will do. Window shall also have blackout panels. Panels shall be rod operated from one side only.

Carpet - (See ETL 00-06: Air Force Carpet Standard and ACC Carpet Guidance. In general, use mainly bold tweed, nylon, and level-loop carpet of at least 28 oz. face weight. Bold tweed means yarn of several different colors, not various shades of the same color. Level-loop is the most hardwearing type of carpet, and bold tweed allows for several upholstery color coordination's in a facility using only one carpet color-way. Again, use a 4" carpet base capped with a vinyl/rubber, dark neutral carpet cap.

Dormitory Carpet - Carpet dormitories by using one carpet pattern per building with a different color-way per floor. Take care to insure that carpet used in living areas is not the same carpet used in the work areas on the base. Do not use dull, drab colors in living areas.

Bedspreads and chair upholstery can be coordinated per floor to the carpet color-way. Draperies in these small living areas are best kept in neutral colorations to blend with the walls. This provides a neutral background for personal items of the occupants.

Carpet Borders - Carpet borders may be solid in color. They may be used with either carpet tiles or roll goods. Be careful not to over-do borders. In corridors a border of about nine inches is about right. Install field carpet in rectangular shapes and allow border to fill in indentation such as doorways, drinking fountains, etc. Do

not use borders in rooms where the furniture will cover the borders.

Systems/Pre-wired Workstations/Modular Furniture – All panel fabrics are to be either brown-tone or gray-tone neutrals. Work surfaces flipper doors, etc. shall complement brown and gray fabric panels. Only one type of systems furniture should be used per building in order to allow greater flexibility in reconfiguration as occupants, needs and requirements change and to provide continuity throughout the space. Systems furniture could be installed over carpet tiles. Removal and installation of new carpet in twelve-foot widths becomes a major undertaking. A professional team must be hired to dismantle, store, and then re-install the systems furniture. This is not efficient or cost effective. Carpet tile will allow for self-help replacement and ease of maneuvering under the systems furniture. Carpet tile will also accommodate flat-wiring for electrical and communications under the carpet.

2.D Door Hardware

Door Hinges - Exterior Door hinges shall be stainless steel, heavy weight ball bearing. Interior hinges shall be stainless steel, ball bearing or plain bearing. All hinges shall be Satin Chrome finish.

Door Closers - Door closers shall be Grade 1, surface mounted, regular or parallel arm mount. Finish shall be BMHA689, Sprayed Aluminum.

Exit Devices - Doors shall have Type 1, rim exit device (no vertical rod type). Push bars shall be rail style as opposed to open bar type. Finish of all exit devices shall be Satin Chrome.

Locksets - Lever handles shall be provided at all locations to allow for full disabled accessibility. Finish of levers, knobs and all miscellaneous visible parts shall be Satin Chrome finish.

Miscellaneous Hardware - Stops, flush bolts, etc. shall be Satin Chrome finish. Misc. hardware associated with bronze aluminum Storefront type entrances may match the doorframe finish.

Armor, kick and mop plates - shall be stainless steel, 0.050" (U.S. 18 Gage).

Thresholds - shall be extruded aluminum.

Exposed rubber parts - on holders, stops and bumpers shall be gray.

Door hardware should be selected and sized on a case-by-case basis for its specific function. In order to unify the quality and appearance of hardware base wide, the above requirements shall serve as the standard of finish and quality level expected of hardware that may not be specifically listed. The Base Architect shall approve all hardware designs and product selections.


Part IV -
Landscape
Standards

1. INTRODUCTION

Holloman AFB's location in southeastern New Mexico in the northern Chihuahua Desert presents unique challenges to the planned landscape. The environmental constraints of the high desert are manifold, and include limited water resources, alkaline and saline soils, and extreme day-to- night temperature fluctuations. In response to these conditions, landscape design shall emphasize native and desert adapted plant species requiring minimal water or pesticides, and adopt low-water-use landscape practices known as "Xeriscape". Appropriate landscape design will positively impact base maintenance operations, support water conservation, and reduce the use of pesticides while improving overall base aesthetics.

2. ACC LANDSCAPE DESIGN POLICY

Landscape design on ACC Bases shall reinforce the same base wide harmony that is described in the architectural design policy statement on page 8.

3. LANDSCAPE PLANNING

3.A Current Conditions

Great effort has gone into the establishment of base wide landscaping at Holloman AFB. With the constraints of the harsh desert climate, traditional approaches - tree lined streets, dense multi-layered planting banks and thick screens of vegetation – are simply not practical. In many cases site walls and building placement serve the visual and wind screening function that hedgerows would provide in a more moderate environment. The most successful landscape applications at Holloman implement basic landscape design principles adapted to the specific climatic constraints. Landscaping is successfully used base wide as visual screening, entry and intersection punctuation, and to define borders and street edges at many individual locations.

While various individual landscape plantings are fairly successful, the most evident landscape planning issue base wide is the absence of landscaping continuity. A base landscape crew is currently adding xeriscape landscape to the major facilities on base. In Zones 2 and 3, for instance, successful landscape treatments may occur on one block, while an adjacent block has no landscaping at all. Successful street edging may abruptly end at a field of gravel and sand. A long-term master plan based on sound landscape design practice can eventually result in the continuity needed. It is not the intent of this document to present a landscape master plan. It is critical, however, to outline general landscape planning approaches that begin to reinforce a base wide visual harmony.

3.B General Requirements

Base wide

Landscaping planning shall be based on Xeriscape practices (See Landscape Standards, Part IV) and incorporate species from the Approved Landscape Plants list in Part VII. It is the designer's responsibility to select specific plant species from the plant list with the appropriate character, height, etc. for the specific function and aesthetic outcome desired.

Planning shall also consider the likelihood of an above average loss of plant material. Avoid planning equally spaced, repetitive rows of planting. The harsh conditions dictate an approach that will allow for loss of some plant material without disrupting the overall planting scheme.

Base wide, landscaping should be used, in conjunction with site walls, for visual screening of mechanical equipment, dumpsters, loading docks, etc. Locate equipment, dumpsters, loading docks, etc. away from building fronts and other high visibility areas.

Plan landscaping to define street edges and punctuate main intersections. See Landscape Standards, Part IV, for examples.

Use landscaping to punctuate parking lot entrances at major buildings and to visually screen parking lots from public view. Refer to Landscape Standards, Part IV, for specific recommendations.

Use of traditionally planted canopy trees and conifers, due to below average survival rates, should be limited. Playgrounds, picnic areas, and community open spaces shall use trees in conjunction with manmade structures if possible to provide shade and shelter.

While encouraged in Zone 4, new tree patterns shall, as with all new landscaping at Holloman AFB, avoid formal repetitive placement that would be adversely affected by the loss of individual specimens.

Zone 1

Mission support facilities and facilities fronting or having prominent facades visible from Delaware Avenue should follow Zone 2 guidelines. Landscape planning for mission specific facilities such as hangars and maintenance/ storage buildings should be purely functionally driven. This could, in some cases, result in no landscaping at some buildings.

Zone 2

Defined entry plazas shall punctuate major, high visibility buildings and major activity areas. Planting, special pavement and site furnishings shall be incorporated as appropriate to reinforce the prominence of the building.

Zone 3

Planting shall be used near buildings to assist in defining primary spaces relating to the building (courtyards, paths, parking, seating plazas, break areas, etc.) and to address building scale.

Zone 4

Landscape in the family housing areas shall be used for privacy screening, be friendly to children, and help define yards and common areas.

In all cases landscaping shall be incorporated to define building entry. Planting should, in general, be more substantial near the building and diminish as distance from the building increases.

4. PLANTING / XERISCAPING

4.A Current Conditions

Existing planting materials and methods visible at Holloman AFB demonstrate, in physical form, the basic landscape conflict that must be resolved in any harsh climate; native versus non-native landscape design. Both can be found throughout at Holloman. While some non-native plants are desert adapted, most imported plant material at Holloman suffers because of the harsh soil and weather conditions. Those that appear to survive, both plant material and groundcover, do so because of drastic measures. Extensive irrigation, construction of plant wells stocked with imported soils, etc. allows non-desert plant species to survive. They are however, high maintenance and are expensive. Even the mature shade trees and established lawns in the military and family housing areas survive based on irrigation. Most native and desert adapted plant material used on the base fares relatively well with limited maintenance required.

The most positive landscape trend on the base is clearly the use of native or desert adapted plant material requiring minimum water combined with gray rock/multi-colored rock with boulders and rock mulch ground covers. This practice, referred to as Xeriscape, reduces the need for irrigation and maintenance. The New Mexico Avenue landscape illustrates a very successful example of a low maintenance Xeriscape application using native plants, gray rock/multi-colored rock ground cover and boulders. Another dramatic application of this approach can be observed at the Intersection of Sixth and Delaware. While variation from this Xeriscape approach may be justified in some instances it is clearly the most logical and aesthetically pleasing landscaping approach currently in use at Holloman.

4.B General Requirements

Utilize Xeriscape principles in all plant material selection and landscape design at Holloman AFB.

Desert plants shall be used as vegetation and shall be able to survive on our 8 inch of annual precipitation even if a sprinkler system is used. See Part VII for the acceptable native or desert adapted plant species that are recommended for use at Holloman AFB.

The harsh conditions of the high desert limit the use of plant material as a viable ground cover. Plant material, if used as groundcover, should be selected based on limited water and maintenance requirements.

Alternatives to vegetative ground covers are the use of grey rock/multi-colored rock and limited wood mulches around plants. Rock in multiple colors and sizes allow a variety of application options. Variations in color and variations in the size of the gravel change the look of the mulch. Use of size variation is encouraged (crusher fines, 3/8”, ½”, ¾”, 1 ½”, 4” and boulders scattered around is encouraged.). Gray river rock shall be 1 ½” as a standard (do not vary) and should be used to economically cover large areas. Colored rock shall be used to break up the “sea of gray”. Grey boulders are discouraged and Franklin Red boulders are encouraged. Multi-colored river rock is encouraged to simulate water paths and cover ponding areas. Mounds, depressions and contours shall be used to break up/add variations to the landscaped area. Use of mounds is encouraged and the use of depressions and swales with round river rock is encouraged. Design shall facilitate drainage away from structures and shall not hinder/block storm water flow. Rock mulch offer sustained color as well as limited maintenance. Landscape that also serves as a force protection barrier is encouraged and shall be used in lieu of concrete/concrete masonry unit walls and/or bollards whenever possible. No landscape

timbers allowed – metal edging and 6 – 8 inch concrete/concrete masonry units ribbons are the only types of edging allowed.

4.C. Approved Products/Treatments

Available through local nurseries

Rock Colors -

Colors: Use only "Franklin Red" crushed rock, "Desert Tan" crushed rock and the common "Gray" 1 ½" river rock – no other types allowed (ie: no lava rock, no pink rock, etc.)

Rock Size-

For "Franklin Red" and "Desert Tan" - crusher fines, 3/8", ½", ¾", 1 ½", and 4".

For "Gray" river rock – 1 ½" only.

River Rock –

Use multi-color 4" to 10" flat/round river rock.

Boulders –

Use "Franklin Red" color only of 2'x2' and 3'x3' or larger rock boulders.

XERISCAPE AS A FORCE PROTECTION BARRIER AT THE DORMITORIES

XERISCAPE AT THE WESTERNER DINING HALL

5. IRRIGATION

5.A Current Conditions

Irrigation is widely used at Holloman to support both native and imported plant materials. Most significant landscape plantings on the base will be irrigated at least until well established. A large portion utilizes permanent irrigation to survive including most lawns, smaller trees and monumental landscape installations. Both "bubbler" and "drip" systems are currently in use. Irrigation, while enabling new plants to establish and older plants to survive, is a burden on an already limited resource. In addition, over watering can draw soil-borne salt to the surface in amounts fatal to many plant species.

5.B General Requirements

Temporary irrigation shall be used as a means to establish native or naturalized landscape installations. Permanent irrigation should be limited to major landscape applications at focus areas and special situations only. Base Civil Engineering and the Base Architect shall approve all irrigation installations and designs.

Drip irrigation systems shall not be used due to mineral buildup in drip irrigation systems, bubbler or spray head type systems with minimum ½" PVC piping and appropriate backflow prevention shall be used.

5.C Approved Products/Treatments

Refer to Base Civil Engineering for current irrigation practices.

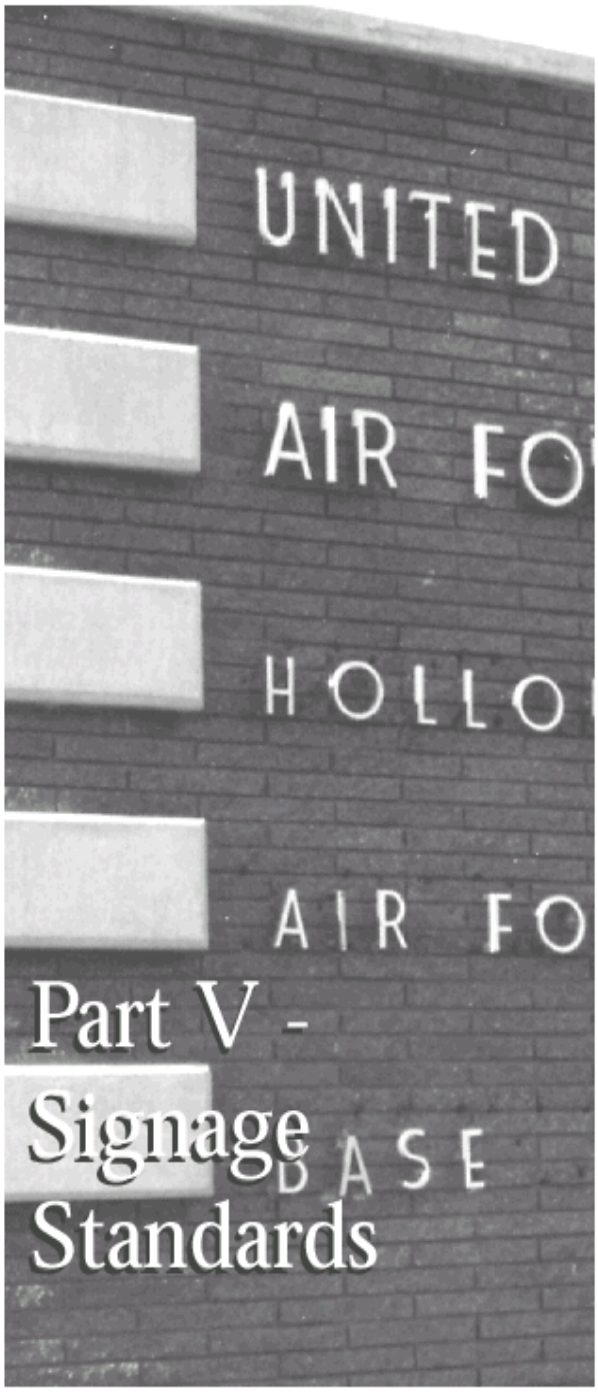
6. LANDSCAPE MAINTENANCE

See Maintenance Manual for Landscape Master Plan, Holloman AFB, New Mexico.

7. APPROVED PLANTS

The approved plant list, in Part VII, represents many species that are suitable for the Holloman AFB microclimate. Only plants listed in Part VII will be allowed on Holloman AFB. Any deviation from this list requires written approval from the Base Architect and the Civil Engineer Environmental Flight. These plants need to be alkaline and drought resistant and must be able to withstand cold temperatures to 15 F.

IRRIGATED PLANT WELLS IN DORMITORY COMPLEX



Part V - Signage Standards

1. EXTERIOR SIGNS

1.A Current Conditions

For the most part, signs at Holloman AFB shall conform to ACCI 32-1054 standards. Exterior signage is generally fairly subtle and in a color palette harmonious with the architecture. Signs are held to a minimum and where special signs (free-standing, marquee signs, etc.) are used they are generally appropriate in size, location and design. As with much of the architectural design at Holloman the more recent buildings present the most positive and consistent sign trends.

1.B Sign Requirements (General)

The number of signs should be held to the minimum required for identification and customer service. Color policy for individual lettering attached to buildings, structures, monuments or entryway glass is white, beige or bronze. Color policy for other types of exterior signs is white letters on brown background and brown posts i.e. HANDICAPPED, RESERVED PARKING etc, with the exception of signs relating to safety and governed by national standards applicable to the USAF. Such exceptions include traffic control signs governed by the Manual of Uniform Traffic Control Devices (MUTCD) and signs governed by OSHA. Examples include regulatory and traffic control signs (speed limit signs, stop signs, yield signs, etc.) and hazard/danger signs required by OSHA. Such special signs mandated by national standards must be of the required colors and design. All signs on base will adhere to standards set forth in ACCI 32-1054 *(except that color shall be white letters on brown backgrounds and posts shall be brown as previously discussed).*

AF DESIGN GUIDE: Unified Facilities Criteria (UFC) 3-120-01 Air Force Sign Standard. Air force design guide for specific types of facilities. Can be obtained from Internet web site http://www.wbdg.org/cb/dod/UFC/ufc_3_120_01.pdf

1.C Building Identification

Buildings on Holloman shall have a street address affixed near the main entrance if required. The street address is necessary to identify the majority of the facilities on Holloman AFB requiring deliveries, i.e. BITS, UPS, USPS, and FEDERAL EXPRESS etc. Building numbers are also used for easy reference and tracking for maintenance and Real Property needs. Building numbers shall be installed and are generally located on the upper right corner of the main entrance wall or facing the nearest main street. Consideration for building number placement is also given to assist in emergency vehicle responses.

Zones 1, 2, and 3

Street address applications shall be individual bronze or complimentary vinyl letters mounted directly to or above the main entrance door where possible.

Building identification signs will require Base Architect approval. Building identification signs shall be individual dimensional Helvetica letters, Duronic Bronze in color, (plastic or cast metal, all capitals) mounted directly to the exterior wall adjacent to the facility's main entry. This guidance also applies to monument type signs.

Zone 4

Addresses on residential units in Zone 4 shall be white pressure sensitive letters on a dark bronze metal panel mounted adjacent to the unit's front door, visible from the street.

Tenant units at Holloman AFB shall follow the same policies as the 49 FW organizations.

1.D AAFES/DeCA Commercial Signs

Logo and lettering supplied by AAFES/DeCA or the parent organization are required to be light bronze or dark bronze.

Format shall be AAFES logo followed by facility name; i.e., AAFES BASE EXCHANGE. This format shall be used for all AAFES facilities including shoppettes, laundries, dry cleaners, military clothing sales, and class six stores.

Logo and facility name shall be the same height and positioned one continuous horizontal line if possible.

Facility name shall be spelled out completely with individual letters.

Logo and letters shall be mounted directly to the building fascia or exterior wall adjacent to the facility's main entrance, visible from the street.

Logo and letters shall be light or dark bronze anodized aluminum or plastic in a light or dark bronze color. Select finish color for maximum contrast and readability.

Logo and letters shall be available in even height increments from 2 inches to 16 inches. Choose the appropriate size and color for each facility and location.

The ratio of height to depth of logo and letters shall be approximately 8 to 1.

Note: Use of Logos/Graphics on other base facilities is discouraged and kept to a minimum i.e. water tanks east of building 29 and the Command patches on building 523.

1.E Monument Signs

Monument-type signs at Holloman shall be constructed of approved split-face or ribbed CMU with a metal sign insert. Monument-sign standard is available from Base Civil Engineering. Do not use post-mounted signs. The Base Architect shall approve all monument-type signs.

MONUMENT SIGN

DIMENSIONAL BUILDING IDENTIFICATION SIGNAGE

1.F Other Signs

Marquee signs are defined as those constructed of masonry, illuminated or non-illuminated, with removable/replaceable lettering for updates. Authorized marquee locations are available from base Civil Engineering. Any requests for new marquees shall receive Base Architect approval.

Revolving or moving signs shall not be used.

Internally lighted signs shall not be used. When night visibility is functionally required, use external flood or spot lights that illuminate both the sign and the adjacent landscape or building.

MARQUEE

1.G Lettering Size

For signs other than those covered by ACC Architectural and Interior Design Standards, size all lettering according to the functional viewing distances. Keep sign sizes to a minimum. The rule to follow for reading ability is one inch of letter height for each 25 feet of view distance. Example: If a sign is intended to be read from a passing car using a road 100 feet away, the largest sign lettering would be four inches (100 divided by 25 equals 4). Do not oversize lettering. Lettering on all base signs shall be of the same style. Uppercase Helvetica medium type style is required. Building numbers at Holloman AFB are typically 12” tall and building names are 18” tall.

1.H. Approved Products/Treatments

Exterior Wall Mounted Dimensional Letters - Individual characters shall be cast aluminum with bronze Duranodic finish to match the base standard. Characters shall be flush mounted against the wall surface using masonry anchors or threaded screws.

Pressure Sensitive Lettering - Vinyl sheeting for die-cut graphics shall have a .003 to .006 film thickness and conform to Military Specification M 43719A. Color shall be white. The sheeting shall have a pre-coated pressure sensitive adhesive backing (Class 1) or positional pressure sensitive backing (Class 3).

2. INTERIOR SIGNS

2.A General Recommendations

The graphics and interior signage shall be provided as a total system and shall be furnished and installed in accordance with ACC Architectural and Interior Design Standards.

Signs shall be constructed of clear matte acrylic plastic with a subsurface printed background color. Office identification signs shall have a clear sleeve to accept paper or plastic insert identifying tenant or tenants. With more than one door to a space, door numbers shall be alphanumeric, i.e. 110A, 110B, 110C. Restroom door signs shall be MEN and WOMEN graphic symbols, centered and mounted on the door with the top edge at five feet six inches above finished floor.

Height and location of signs shall be in accordance with UFC 3-120-01 (as of Feb.-6-2003) unless otherwise specified. Signs shall be mounted using either vinyl tape or adhesive as recommended by the manufacturer for the specific application. Adhesive shall cover the entire back surface of the sign panel. Signs shall be mounted in place after all other interior work in the immediate vicinity has been completed.

2.B Approved Sign Types

Refer to the Air Force Sign Standards, UFC 3-120-01 (as of Feb.-6-2003), for a full description and specifications of interior sign types. Signs shall comply with all ADA and UFAS requirements where applicable.


L.P STEAM
Part VI -
Engineering
Standards

1. STREETS

1.A Current Conditions

The streets of the main base area are in a grid oriented roughly northwest southeast and southwest northeast. Zone 4, the Family Housing area, exhibits a more serpentine residential street pattern with some cul-de-sacs, typical of "neighborhood" planning. First Street is the primary artery leading from the main gate to the flight line. Several roads intersecting First Street provide secondary loops and cross connections between various areas of the base. These include New Mexico Avenue, Delaware Avenue, Mesquite Road, and Arizona Avenue. Delaware Avenue is also the boundary between the main base area and the flight line.

Roads are currently well maintained, almost all with curb and gutter and generally well marked Street edge treatments, however, vary greatly. Traffic markings are made by use of 3M A420 (White) or A421 (yellow) traffic tape or equal on all major roads and encouraged use on secondary roads.

Along First Street, for example, gravel and landscape beds abruptly transition into areas planted with struggling imported turf. Many streets have no edge treatment other than sidewalks and vast areas of gravel ground cover. There are no extended, consistent street edge treatments that might define major roadways and contribute to the visual "sense of place" at Holloman. There are bright spots, however. Pedestrian lighting combined with gravel groundcover and landscaping create a strong, formal street edge at the Child Development Center. Attractive landscape treatments can be seen at several main intersections (the intersection of New Mexico Avenue and First Street, for example) and at parking lot entrances such as at Building 317.

SUCCESSFUL LANDSCAPE TREATMENT IDENTIFIES BUILDING 317'S PARKING LOT ENTRANCE AND DEFINES THE STREET EDG

Along the flight line side of Delaware Avenue, a strong street edge is beginning to develop due to the construction of several prominent masonry site walls in combination with dramatic indigenous landscaping. There are even a few tree-lined streets in the family housing zone. These street edge treatments are positive trends that create, if only in isolated pockets, visual edges and punctuation points at main roadways and destination points.

1.B General Requirements

General streetscape improvements shall be considered as an integral part of any new street improvement or building construction project. The introduction of Xeriscape along existing street edges along with hardscape improvements, i.e., concrete sidewalks, site furnishings and light standards will improve the overall aesthetics and begin to create a sense of place for Holloman Air Force Base.

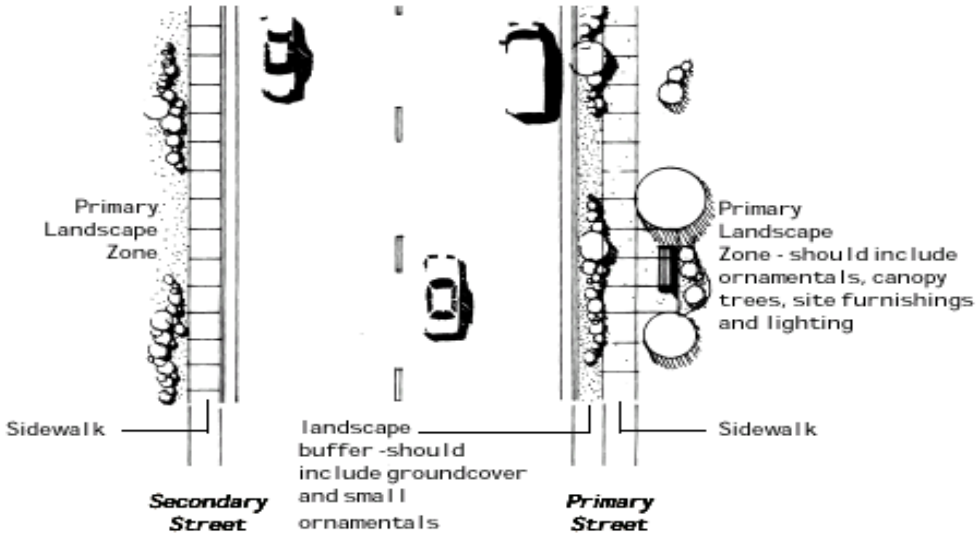
Street edge landscaping is required on all primary and secondary roads. Although larger approved specimen trees may be used at strategic locations, the development of an evenly spaced shade tree street edge is not recommended in the microclimate of Holloman.

Major intersections and major parking lot entrances shall be punctuated by landscaping applications. Minimize landscaping and site walls within 50 feet of intersections and entrances to three feet in height to ensure minimum 100 foot unobstructed views of traffic. Ensure no walls, shrubs or trees should occur within 20 feet of any road intersection that may obstruct views. Refer to Department of Defense standards for exact unobstructed view requirements.

Construction standards in accordance with DoD Force Protection Requirements must adhere to the Unified facilities Criteria (UFC) 4-010-01 and AFH 10-222, Vol 3. All Installation Entry Control Facilities to include Visitor Centers must comply with the Air Force Entry Control Facilities Design Guide. AFI 10-245, DoD Std 28 and AFH 10-222, Vol 3.

AFI: AIR FORCE INSTRUCTIONS. Can be obtained from Internet web site **http://www.e-publishing.af.mil/**

Additionally, all new building construction projects at Holloman are required to comply with curb-to-curb development. That is, as part of the project, the design scope of the site needs to extend from curb to curb of the site that borders existing stree



REQUIRED STREET EDGE TREATMENT AT PRIMARY AND SECONDARY STREETS

Masonry site walls (see Part II, Architectural Standards, section 7) shall be continued along the northwest street edge of Delaware Avenue as both a defined boundary and a visual buffer between the flight line area and the remainder of the base.

Site walls shall be incorporated along street edges at neighborhood boundaries and at boundaries between mission zones and other base zones.

1.C Approved Products / Treatment

Traffic Markings -
Provide on all major roads and encouraged use on all secondary roads 3M A420 (White) or A421 (Yellow) Traffic tape or equal.

Refer to Part II, Architectural Standards, Section 7, for approved site wall materials and treatments. See Part IV, Landscape Standards, Sections 3 and 7, for approved plant materials and applications.

Alkali-aggregate reaction is a chemical phenomena involving the reaction of alkalis from the portland cement and certain aggregates in concrete. This reaction forms a gel around the rim of aggregate particles and this gel absorbs water that can lead to destructive expansion of the portland cement concrete, This expansion may result in map cracking in the surface of the concrete, popouts, spalling, expansion of the concrete, or some combination of symptoms. The aggregates involved in such reactions are usually certain forms of silica (alkali-silica reaction) and much more rarely certain forms of dolomitic aggregates (alkaili-carbonate reaction). These reactive aggregates may be either the fine or coarse aggregate or both. Damage from this reaction may become evident after just a few years or it may take decades to develop.

A preliminary assessment of the alkali-aggregate reaction problem in the Air Force has tentatively identified at Holloman AFB, NM as having reported alkali-aggregate reaction problems.

SUCCESSFUL STREET EDGE TREATMENT AT CHILD DEVELOPMENT CENTER

Aggregate sources in the vicinity of Holloman AFB, NM have been recently tested by the government for Alkai-Silica Reactivity. Contact the Albuquerque District, US Army Corps of Engineers (COE), 4101 Jefferson Plaza NE, Albuquerque, NM 87109-3435. Aggregates to be used for concrete production shall have a measured expansion equal to or less than 0.1 or les IAW current COE guidance, when tested using ASTM, C 1260 modified to incorporate the mix design proportions of cementitious materials.

As a recommendation, course and fine aggregates shall be washed.

Aggregate shall be evaluated and tested by the contractor for alkali-aggregate reactivity in accordance with ASTM C 1260 (Modified). ASTM C 1260 shall be modified as follows:

Utilize Type V low alkali cement and Class "F" fly as in combination as the cemetitious material for the test.

Project Class "F" fly ash shall be used at a rate of 30 percent of the total cemetitious material by mass.

The maximum allowable expansion shall not exceed 0.10% at 16 days. The results of such testing investigation shall be submitted to the contracting officer for evaluation and acceptance.

2. PARKING

2.A Current Conditions

A variety of parking configurations, both good and bad, can be observed at Holloman. In Zone 2, the intersection of Tabosa and Arkansas Avenues illustrates the range. A well-screened and landscaped parking lot serving Building 71 demonstrates how lot placement and landscaping can minimize the impact of parking. Directly adjacent, at Building 55, parking extends solidly from the street edge to the building, with no landscape buffer, visually blocking the building entrance. Parking overwhelms the building. In Zone 4, there is a mix of on street, driveway and small lot parking; off-street parking is at a premium.

2.B General Requirements

Do not locate parking directly in front of a building or entrance. Do not locate parking between a main viewing street and the building. If possible, parking should be located behind the building it serves. In no cases should parking be designed "on-street". Follow all AT/FP guidance in determining the location and standoffs for all parking lot development at Holloman.

All construction shall be in accordance with DoD Force Protection Requirements and shall adhere to AFI 10-245, DoD Std 28, and AFH 10-222, Vol 3.

Effective screening helps soften the visual character of large parking areas. Parking lots at Holloman shall be screened from public rights of way and adjacent buildings by approved landscaping or solid masonry site walls along major street edges.

Use separate parking lots accommodating 50 cars or fewer rather than large lots of 200 or more. Where large parking lots exist or are required by functional layout, landscape approximately ten percent of the lot. Screen the lots and break up any large expanses of paving with planting islands and buffer strips. Plant evergreen shrubs with a minimum height of 4 feet (3 feet minimum at installation) combined with Xeriscape placed at the lot perimeter and in the islands.

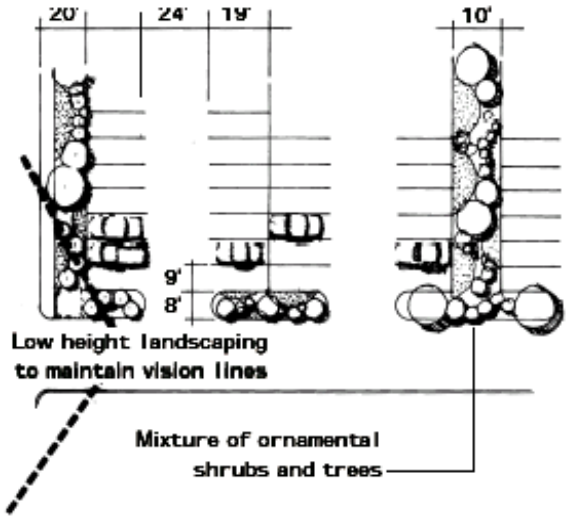
Parking areas shall have standard and handicapped stalls, and twenty-four feet wide driving aisles. Standard parking stalls should be designed to a minimum of 9'x18'. Handicapped stalls shall be either standard parking stalls with

a 5’ common area between stalls or an expanded standard stall, minimum of 12’x18’. All parking areas are to be striped and signed per Holloman standards.

Zone 4 parking shall generally allow for an average of 1.5 spaces per unit of off-street parking. Additional parking shall be accommodated through the use of strategically placed banks of parking spaces perpendicular to the street.

2.C Approved Products/Treatments

See Part IV, Landscape Standards, sections 3 and 7, for approved plant materials and Xeriscape applications.



RECOMMENDED PARKING LOT TREATMENT

(TOP) EFFECTIVE PARKING LOT – ALTHOUGH LOCATED IN FRONT OF THE BUILDING, THE SMALLER SIZE AND WELL SCREENED PERIMETER MINIMIZE ITS IMPACT

(BOTTOM) INAPPROPRIATE PARKING LOT – TOO LARGE, LOCATED DIRECTLY IN FRONT OF BUILDING, LACKS LANDSCAPE SCREENING

3. SIDEWALKS/CURB AND GUTTER

3.A Current Conditions

Sidewalks and curb and gutter installations are generally present and in fairly good condition base wide at Holloman. Some however do show signs of deterioration due to the soil conditions. The continued use of sidewalks and curb and gutter at appropriate locations should be considered mandatory and a requirement for every new construction project throughout all zones.

3.B General Requirements

Sidewalks shall be utilized within pedestrian use areas along streets and parking lots.

Sidewalks shall be a minimum four feet wide, with eighteen-inch wide gutters with six-inch high curbs, or any combination thereof, as appropriate. For new construction projects, if existing sidewalks do not meet these standards, the project is responsible for replacing or modifying them to meet that standard. The design responsibility for all new projects is curb-to-curb and that includes sidewalks and landscape. Sidewalks shall have ramps at each street intersection designed per ADA guidance and in locations where heavy pedestrian traffic requires access to a sidewalk.

Due to high salt content in native soils, H2O intrusion must be minimized to prevent sinkholes. All joints shall be sealed, preferably with cold applied single component silicon sealant.

4. PEDESTRIAN CROSSWALKS

Past experience has led to a new Holloman AFB standard of using synthetic fibers in lieu of WWF (welded wire fabric) in concrete, 6" thick or less. If additional reinforcement is required use #4 grade 60 steel bar reinforcement.

4.A Current Conditions

Well-defined crosswalks, those easily identified by vehicular traffic, are currently at a minimum at Holloman AFB. Although traffic over most of the base cannot be classified as heavy, several major pedestrian/vehicular conflict spots are present.

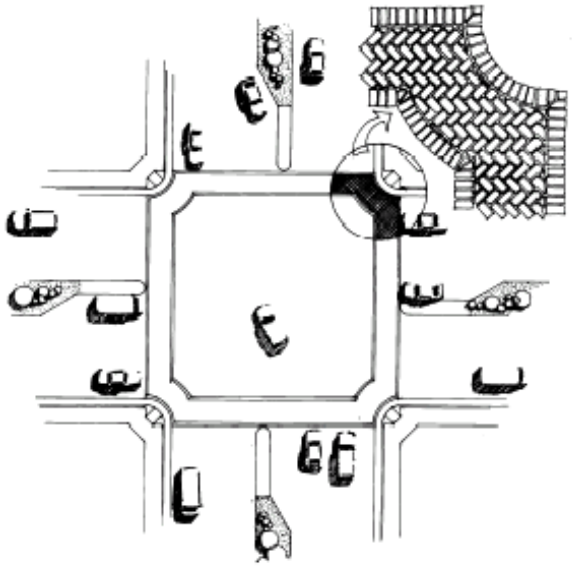
4.B General Requirements

Inclusion of pedestrian crosswalks at intersections shall be included as a part of any paving or street improvement project at Holloman AFB.

Accessibility for disabled pedestrians presently conflict with current QDA guidelines. All construction shall comply with ADA Accessibility Standards.

High traffic intersections must ensure cross-walks are marked according to MUTCD (Manual for Uniform Traffic & Control Devises).

A pattern should be applied using paint or high reflective tape.



RECOMMENDED PEDESTRIAN CROSSWALK AND TREATMENT

5. UNDERGROUND PLUMBING

5.A Current Conditions

The soil at Holloman Air Force Base is underlain with poorly-drained soils of fine loam, formed in gypsiferous sediments of folian or alluvial. The soil is highly corrosive. The water table varies from 3 feet to 15 feet below the ground surface.

5.B General Requirements

Water piping shall be designed for a maximum velocity of 3 fps or per manufacturer's recommendation, whichever is less. Only non-ferrous piping shall be used. Plastic piping shall be pressure pipe capable of withstanding 165 psi. Trenching, back filling, and pipe installation shall be done according to manufacturer's recommendations. Pipe shall have minimum cover of three (3) feet of clean fill. Tracer wire shall be provided for all non-ferrous buried piping.

No pressure piping shall be allowed under slabs-on-grade unless it is in a crawl space or pipe chase except for the service entrance. The service entrance shall be perpendicular to the slab edge and not extend more than 5 feet under the slab.

Sanitary sewer lines shall be designed in accordance with UFC 3-240-07FA and installed according to manufacturer's recommendations with not less than a 2.fps hydraulic velocity flow; minimum size of the sewer lateral from the building to the street sewer main shall be 4 inches. The designer shall take into account the prevailing soil conditions when selecting pipe materials. To extent feasible, do not locate sewer pipes and manholes under pavement. Provide manholes at junctions, changes in direction, changes in slope, and changes in invert elevations of sewers 8 inch and above. Clean-outs are required for 4 and 6 inch sewers. Limit spacing between manholes to 300 feet, except 500 foot spacing is permitted in straight runs of long out-fall sewers.

Limit storm sewers serving drainage inlets to not less than 8 inch diameter and building connections to not less than 4 inch diameter. Establish storm sewer slopes to provide minimum velocity of two feet per second when pipe is flowing full. Maximum storm sewer design velocity shall be in non-erosive range for specified pipe material. Design all components of storm sewerage system on basis of not less than 10-year storm frequency for one hour.

Sewer manholes shall be pre-cast reinforced concrete manhole sections. Both the exterior and interior surfaces of the manholes shall be epoxy coated. Manholes shall conform to ASTM C478-72. Position manholes at every change of direction and shall not exceed a maximum distance of 300 feet apart.

Provide University of Southern California approved, reduced pressure back flow preventers at the service entrance. The mechanical make--up water system shall have a separate air gap type (10 gallon tank and float with pressure actuated gear driven pumps) back flow prevention device.

Gas lines shall have a maximum working pressure of 60 PSIG. Gas risers shall be anodeless type.

5.C Approved Materials/Treatments

Supply Piping - shall be non-metallic such as:
- Polybutylene (PB)
- Chlorinated Polyvinyl Chloride (CPVC)
- Polyvinyl Chloride (PVC)

Waste, Vent, and Drainage Piping - shall be non-metallic, such as:
- Acrylonitrile-Butadiene-Styrene (ABS)
- Polyvinyl Chloride (PVC)
- Polypropylene (PP)
- Filament-wound Reinforced Thermo-setting Resin (RTRP)

Gravity Sewer Piping - shall be non-metallic, such as:
Polyvinyl Chloride (PVC) Type PSM meeting ASTM D3034 or F679 for SDR 35, solvent weld or gasket joints
Pressure *Sewer Piping* - shall be non-metallic, such as:
Polyvinyl Chloride (PVC) AWWA C900 Class 150 (DR18) or Class 200 (DR14)

Gas Piping - shall be non-metallic, such as:
Polyethylene. It shall comply with Department of Transportation (DOT) requirements.

6. ABOVEGROUND PLUMBING

6.A Current Conditions

Conditions within the buildings are per industry standards with piping run at right angles to the structure and insulated. Waste piping under slabs exits the building by the most direct route.

6.B General Requirements

In buildings normally occupied by more than 15 persons, provide separate toilet rooms for each sex; position them adjacent to each other and use a common wall for the plumbing chase. In buildings occupied by 1 to 15 employees, a single unisex toilet may be provided. All new buildings shall have at least one handicap accessible toilet for each sex regardless of facility function or mission.

As a minimum, furnish one water closet, one lavatory, and a room door that can be locked from the inside for buildings in Zones 1, 2 and 3.

6.C Approved Materials/Treatments

Water Supply Piping - PVC/CPVC suitable for transporting water above 150F

Compressed Air Supply Piping - shall be black steel with malleable iron fittings.

Waste and Vent Piping - PVC/CPVC
Drainage Piping - PVC/CPVC

7. PLUMBING FIXTURES

7.A Current Conditions

The plumbing fixtures presently installed at Holloman Air Force Base have been selected based on Federal Specification WW-P-541.

7.B General Requirements

Energy conservation washer-less fixtures shall be all metal construction, no chrome-plated plastic. All water saving techniques shall be considered, including 1 gpm flow restrictors for faucets, 3 gpm low-flow showerheads, single control mixing type faucets, low-volume flush water closets, 3 gallons or less, and self-closing faucet valves. Showers shall have valves with pressure balance features. Utilize freeze less wall hydrants. Provide interior wall access (self-draining) with hose attached. Wall mounted drinking fountains are preferred.

All applications of plumbing fixtures shall be considered for handicapped usage as directed by Air Force guidelines, ADA requirements, and the UFAS standards.

The following table suggests plumbing fixture types for the four zones. The codes below describe different types of each fixture and identify which zones are appropriate.

1. *Water closets* – Flush-o-meter valve, siphon-jet, elongated bowl, top supply spud, floor or wall mounted. Seat: Plastic, elongated, open front

2.*Water closets (handicapped)* - Top rim of bowl shall be 18" above the floor. (All others same as #1)

3.*Water closet* - Siphon-jet, elongated bowl, flush tank, floor mounted. Seat: Plastic, elongated, open front with seat cover.

4. *Lavatories* - Enameled cast iron or vitreous china. Faucet: as required.

5. *Lavatories* - Enameled cast iron or vitreous china, counter top. Faucet: as required.

6. *Wheelchair sinks* - Vitreous china, 20 inches by 27 inches deep.

7. *Urinal* - wall hung. Siphon-jet or washout.

8. *Kitchen sinks* - Single or double bowl, ledge back with holes for faucet and spout, stainless steel. Faucet - as required.

9. *Service Sinks* - Enameled cast iron. Trap standard, wall mounted or floor mounted. Faucet - as required.

10. *Food Service Sinks* - Stainless steel with drain board. Faucet - as required.

11. *Water Coolers* - Self contained. Exposed surfaces shall be stainless steel. Wall mounted surface. Wall mounted semi-recessed. Wall mounted recessed. Handicapped. Free standing.

12.*Showers* - Wall mounted for stall or bathtub. Valves - as required.

13. *Bathtubs* - Straight front recessed. Enameled cast iron, porcelain enameled. Formed steel, plastic without wall, plastic with high wall.

Fixtures	**Zone 1 Mission/Industrial**	**Zone 2 Mission Support/ Administrative**	**Zone 3 Community**	**Zone 4 Military Family Housing**
A. Water Closets	1, 2	1, 2	1, 2	3
B. Lavatories	4	4	4	5
C. Urinals	7	7	7	
D. Sinks (Kitchen)		8	8	8
E. Sinks (Service)	9	9	9	
F. Sinks (Food Service)	10	10	10	
G. Sinks (Medical)	6	6	6	6
H. Water Coolers	11	11	11	
I. Showers	12	12	12	12
J. Bath Tubs			13	13

8. HEATING

8.A Current Conditions

Heating throughout the base, at present, is accomplished with gas-fired furnaces, gas-fired boilers or electric heat pump systems. The transfer medium is either hot air or hot water. Presently there are various HVAC equipment components located outside or on buildings, which do not enhance the appearance of the structure. The base has no central heating plant; the climate in the area does not justify the need for one.

8.B General Requirements

The indoor design temperature for comfort heating for administrative spaces shall be 65° - 70°F when occupied and <55°F when unoccupied. Shops and occupied storage shall

be maintained at 55 °F when occupied.heating will be 68 °F in areas with low levels of physical activity, and 55 °F in areas of moderate to high levels of physical activity. The indoor design temperature for freeze protection will be 40 °F. Provide humidification as required by other standards to maintain healthy conditions for occupants or to reduce static electricity.Where indoor relative humidity is expected to fall below 20% for extended periods, humidification may be added to increase the indoor relative humidity to 30%. Humidification systems shall be provided which do not use corrosion inhibiting chemicals commonly found in central steam systems. Humidifier equipment shall only discharge potable water or potable steam.

The use of cast iron boilers is discouraged. Provide boiler water testing sample points on all hot water systems. Provide chemical feeding systems on all hot water heating systems. Heat gain and loss calculations may be increased up to 10% to account for unanticipated or undefined loads or changes in space usage. Increase boiler and heating coil capacity by 15% for normal pickup. Where the control system utilizes a night setback strategy, the equipment capacity may be increased by 30%, if justified by the load calculations. Ignore internal and solar loads in calculations for sizing of heating equipment. Include forced and natural ventilation. Where pipes exceed 30 meters in length, calculate piping losses and add to the boiler capacity.

Provide automatic pilot less ignition systems on all gas-fired equipment. Install temperature sensors on heating supply and return lines. Install pressure gauges with valves on suction and discharge lines to all pumps. Install gas pressure gauges with valves on all gas trains on boilers.

The size of mechanical rooms and the access to the equipment for servicing is one of the most important considerations in designing new systems. Maintenance of the coils, filters, valves, and pumps, along with tube removal or servicing shall be considered when designing mechanical systems and their enclosures.

Access to the mechanical room shall be from the exterior o the building. Backup unit gas heating is required in all mechanical rooms with water service entrances, water devices, etc.

Holloman has only a handful of buildings that fit the category of office building. Among these are: 49th Fighter Wing Headquarters, Base Operations, and the base hospital.

Mechanical equipment shall not be located on roofs. All ground mounted mechanical and electrical equipment shall have a factory applied finish meeting HAFB color standards and shall be screened from view in accordance with UFC 4-010-01.

Where humidification is required, steam humidifiers shall be used. Solar heating systems are to be considered when the base indicates that budgeting conditions are favorable for studying their incorporation into the design of a building. These systems are especially useful in remote areas where natural gas lines are not available.

Design Conditions shall be as follows:

Latitude	32° 51’
Longitude	106° 06’
Elevation	4093 feet
Winter Design @ 97.5%	26° F outside
Heating Degree Days	3451

Energy Sources: natural gas for furnaces and boilers, and electricity for heat pumps. Solar energy is available if the basic scope of a project will allow for its use in design.

The equipment selection should be based on the system selected to provide the most energy efficient combination.

Equipment types to be used:

Type-1 Boilers shall be steel water tube or fire tube.

Type-2 Heat exchanges shall be shell and tube type or plate type.

Type-3 Heat pumps shall be air-to-air, water-to-air or geothermal closed loop.

Type-4 Circulating pumps shall be centrifugal base mounted, inline horizontal or vertical.

Type-5 Unit heaters shall be horizontal or vertical.

Type-6 Air handling units shall be blow through or draw through packaged type.

Type-7 Fan coil units shall be horizontal, vertical or through the wall type.

Type-8 Radiant heaters shall be natural gas fired.

Type-9

Applicable Equipment Types:
Zone-1 Type-1,2,4,5,6 and 8.
Zone-2 Type-1,2,3,4,6 and 7.
Zone-3 Type-1,2,3,4,6 and 7.
Zone-4 Type-1,3,4,7 and 9.

Controls: New Direct Digital Control (DDC) controls systems and modifications to existing systems will be designed to be compatible with the existing EMCS System and based on the EIA 709.1B (LonWorks) protocol. Manufacturers of controls equipment produce controls parts that are slightly different in size, connections, features, and whether the controls are pneumatic or electric. Due to these differences, it is highly desirable to use the existing manufacturer of controls for the base systems. This ensures commonality of parts, and helps technicians to troubleshoot maintenance problems regardless of the complexity of the controls system in a building. Temperature controls will be used to the fullest extent consistent with economy of operation. They will be adequately protected against unauthorized adjustments or tampering (locking covers). Heating systems shall be provided with a control for positive cut-off above 65 F outside temperature.

9. AIR CONDITIONING

9.A Current Conditions

Mechanical refrigeration is presently used in general for living quarters, office buildings, dining halls and clubs, hospitals and clinics, and shop areas with equipment requiring a controlled environment. There is no central cooling system on the base.

9.B General Requirements

Indoor design temperatures for comfort cooling in occupied offices, auditoriums, computer rooms, etc., shall be not lower than 7674 °F or higher than 8078 °F. The indoor specific humidity is usually not considered an issue during cooling season unless otherwise stated for specific facilities. Garages, equipment rooms, and non-temperature controlled storage rooms shall be unconditioned.The indoor design temperature provided by evaporative cooling or comfort mechanical ventilation will be 80 °F.

The use of cooling towers shall be avoided. Evaporative coolers shall not be generally installed on the roof. All condensing units shall be air-cooled. Select air-cooled condensers based on 105 °F. ambient temperatures. Centrifugal chillers are prohibited. A central mechanical system shall normally be provided unless specific engineering cost analysis indicates sub systems to be more economical. Locate equipment designed to operate outside behind architectural screening. Avoid locating outside equipment near the main entry of buildings.

Access to equipment for servicing is critical when designing new systems. Coils, filters, valves, pumps or tube removal or servicing is to be considered when designing mechanical systems.

Sloped roofs shall not have any equipment located on them. All equipment located closer than 10 feet from the edge of a flat roof shall have a safety railing.

Equipment located on the ground shall be hidden from view by screens, landscaping, etc.

Design Conditions shall be as follows:

Latitude	32° 51’
Longitude	106° 06’
Elevation	4093 feet
Summer Design Outside	97 °F DB/68 °F WB

Solar heat gain calculations shall be prepared for all building construction projects at Holloman AFB.

Energy Source: All mechanical refrigeration equipment selected for installation shall make exclusive use of electricity.

*Equipmen*t: shall be suitable for the application.

Type-1: Chillers shall be packaged air-cooled type.

Type-2: Evaporative coolers shall be up-blast or vertical discharge closed circuit type or cellulose material impregnated with antirot salt and rigidifying saturants. Media efficiency shall be 76% at 600-FPM face velocity with no entrainment of pad water. Open evaporative coolers shall be designed to provide an indoor temperature of 80 F.

Type-3: Heat pumps shall be air-to-air, water-to-air or geothermal closed loop.

Type-4: Circulating pumps shall be centrifugal base mounted, inline horizontal or vertical. Pumps shall be specified to have the motor and pump be base mounted as a unit to ensure proper alignment between the pump and motor prior to connection to the piping.

Type-5: Air handling units shall be blow through or draw through packaged type.

Type-6: Fan coil units shall be horizontal, vertical or through the wall type.

Applicable Equipment Types

Zone-1: Type-1, 2, 4, 5 and 6.

Zone-2: Type-1, 2, 3, 4, 5 and 6.

Zone-3: Type-1, 2, 3, 4, 5 and 6.

Zone-4: Type 3 and 6.

Controls: New Direct Digital Control (DDC) systems and modifications to existing systems will be designed to be compatible with the existing EMCS System and based on the EIA 709.1B (LonWorks) protocol.controls systems and modifications to existing systems will be designed to be compatible with the existing EMCS System. Manufacturers of controls equipment produce controls parts that are slightly different in size, connections, features, and whether the controls are pneumatic or electric. Due to these differences, it is highly desirable to use the existing manufacturer of controls for the base systems. This ensures commonality of parts, and helps technicians to troubleshoot maintenance problems regardless of the complexity of the controls system in a building. Temperature controls will be used to the fullest extent, consistent with economy of operation.

10. HVAC CONTROLS

All control systems shall be direct digital control (DDC). All damper and valve actuators shall be electronic with a control signal of either 0-10 VDC or 4-20ma. Pneumatic Devices shall not be used unless required for interfacing to existing devices in remodeled areas.

The DDC System shall be installed according to the I/O summary chart for the mechanical systems listed below. The Input/Output summary sheet shall apply to all equipment included in the project design control scheme, whether equipment is existing, modified, or a provision of the project

1. Chillers and associated pumps
2. Boilers and associated pumps
3. Air handlers and any associated VAV boxes

4. Computer Room AC Units (CRAC)
5. Exhaust Fans
6. Packaged Heating/cooling equipment

All building DDC for HVAC equipment shall be based on LonWorks using a LonWorks Network Services (LNS) database and LonMark certified devices compatible with the existing base-wide Energy Monitoring and Control System (EMCS).

When stipulated in the design, all communications connections shall be made by the Contractor to government furnished communications media at the nearest telephone panel. The Government will furnish all pair assignments. Modems shall be integrated into the DDC equipment panels and provided by the DDC equipment manufacturer.

The EMCS integration shall include complete installation of all hardware and software. This shall include but not be limited to the LNS database conforming to the I/O schedule, system graphic displays, and all applications programming necessary to accomplish the specified sequences of operation. All points required for operation shall be provided in software and hardware.

The Contractor shall perform a complete point-to-point test of the completed DDC/EMCS installation. The test shall be conducted by measuring each analog value with a test instrument twice as accurate as the device being measured. The test equipment shall be certified traceable to NIST standards. Each value shall be calibrated in either hardware of software to the specified accuracy. All outputs shall be exercised on/off or full-scale analog to verify operation of each channel and device. All digital inputs shall be tested by exercising the connected device such as a freeze-stat, smoke detector or differential pressure switch, with a simulated input condition. Pressure switches for filter status shall be calibrated to the specified pressure using a magnehelic gauge. All test

results shall be recorded and documented by the contractor and included in the Operation and Maintenance Manuals furnished to the Government.

The contractor shall provide a portable testing and troubleshooting device for use with the completed DDC/EMCS. The portable device shall be supplied with an approved LNS Network Configuration Tool along with the project's database and communications software/ hardware required to communicate to the DDC/EMCS system.

11. ENERGY EFFICIENCY AND WATER CONSERVATION

Insulate all fluid conveying piping. Insulate all ductwork carrying conditioned air through unconditioned spaces. Recover heat from exhaust air if cost efficient. Minimum SEER = 12.0 for residential only, minimum COP - 2.5. Energy efficiency and water conservation is more than just installing light bulbs that use less energy and showerheads that spray less water. It is also a commitment from people to act individually in using less energy and water. This requires a careful balance to keep people in the workplace productive and continue the mission of the base.

At a minimum the following engineered items must be included in construction, repair and renovation.

Insulate all fluid conveying piping. The insulation must at least have a positive hold double wrap feature to ensure it doesn't split open during the life of the insulation.

Insulate all ductwork carrying conditioned air though unconditioned spaces. The insulation must have the same double wrap feature to prevent the insulation from splitting at the seam. Use windows that include a double pane and feature low emissivity and other polarizing effects against sunrays.

Current and near future technology makes it possible to achieve high efficiency in

mechanical and electrical equipment. These parameters must be considered from a cost advantage as part of the overall project cost.

Where possible include simple architectural techniques to provide solar light shelves that provide natural sunlight into a work area and help reduce the need for artificial lighting. Panels with an architectural feature can be incorporated to reduce or eliminate direct sunlight into windows during peak hours, thus reducing heat input into a building.

If cost effective, include heat wheels in the exhaust duct to heat the air intake in the fresh air duct. Conduct a preliminary economic analysis to ensure there is a benefit to this feature.

Air Conditioning systems for residential use shall have a minimum SEER = 12

Air Conditioning systems shall have a minimum COP = 2.5

Chillers less than 400 tons capacity shall use screw compressors and ensure a 50% load efficiency of less than 0.5 Kw/ton.

12. FIRE PROTECTION

12.A Current Conditions

Most buildings on base have some type of fire protection system. The type found depends on the level of protection needed, the environment, which the system is to operate in, and the age of the facility.

12.B General Requirements

All sprinkler systems shall be hydraulically designed. Pipe sizes, sprinkler locations, and data for hydraulic calculation sign shall be shown on the drawings.

All new dry/wet fire suppression systems connected to potable water supplies and using water only as a fire suppressant shall have an approved double check valve backflow preventer and test station.

All buildings shall be equipped with MONACO BT-XF narrowband building radio fire alarm transceiver which reports to MONACO D-21 fire alarm monitoring system, which includes antenna compatible with an existing Monaco D-21 Radio Fire Alarm Monitoring Systems. Provide antenna and lightning protection as recommended by Monaco. Each transmitter and interface device shall be the manufacturer's current commercial product completely assembled, wired, tested at the factory, and delivered ready for installation and operation. All cabling shall be in conduit, whether exposed or concealed.

Provide intelligent addressable fire alarm control panel, using the Notifier AFP-200 or NFS-640 made by Notifier Fire Systems, Northford, CT. Each device shall be addressable. Devices are pull stations, duct smoke detectors, heat detectors, flow switches, pressure switches, temper switches and any initiation devices. Any initiation devices shall be addressable.

Design Conditions: The design shall be in compliance with Unified Facilities Criteria (UFC) 3-600-01. Fire Protection for Facilities Engineering, Design, and Construction; Engineering Technical Letter (ETL) 02-15: Fire Protection Engineering Criteria - New Aircraft Facilities; ETL 98-8: Fire Protection Engineering Criteria - Existing Aircraft Facilities; ETL 01-18: Fire Protection Engineering Criteria – Electronic Equipment Installations; Air Force Instruction (AFI) 32-1066: Plumbing; and National Fire Protection Association (NFPA 13): Installation of Sprinkler Systems.

Distribution: The underground piping systems shall be PVC. Aboveground piping systems shall be Schedule 40 steel threaded or welded. Schedule 80 copper with high temperature solder and Schedule 10 steel can also be used above ground.

Alarm Systems: All buildings shall be monitored for fire signals back to the main base Fire Station.

For dormitories three stories or higher all areas must be sprinkled and the sprinkler system must be connected with the existing base alarm system. Dormitories shall have dual detection systems, heat/ smoke in sleeping room with a local room alert.

Provide reduced pressure back flow preventors on all service entrances.

13. UNDERGROUND ELECTRICAL

13.A Current Conditions

There are three (3) existing primary substations with a total of 55 MVA and with a potential of 85 MVA. The primary voltage is 13.2/7.6 KV. The secondary is 480/277V or 208/120V and in some cases 240V.
Housing areas are on a different distribution system with a 12.46KV primary voltage.

13.B General Requirements

Materials and installation shall comply with the latest revisions of National Electric Safety Code and the National Electric Code (NFPA 70).

Because of the corrosive soil conditions, under ground electrical distribution shall be 6-way PVC duct encased in concrete. Provide one (1) spare conduit. Use "stirrup" connectors to connect service feeders to overhead conductors.

*Design Condition*s: The design of underground distribution systems shall be based on the calculated demand with sufficient electrical capacity for expansion if allowed or if within the budget.

Materials: The materials indicated above shall be comprised of plastic conduit encased in concrete. Allowable plastic conduits include PVC, fiberglass or similar nonmetallic electrical duct.

Underground distribution shall have junction boxes with load breaks and not manholes. Excess distance between access points shall be avoided. 250 feet between access points is the desired maximum.

14. ABOVEGROUND ELECTRICAL

14.A Current Conditions

Overhead transmission and distribution lines currently exists in most areas of the base. Future overhead electrical distribution shall not be used on the base unless written approval is obtained by the Base Architect. Underground electric service is the standard for the base and shall be included for all service connections.

14.B General Requirements

Materials and installation shall comply with the latest revisions of National Electric Safety Code and the National Electric Code (NFPA 70).

Overhead Transmission and Distribution Lines: If overhead transmission lines are used due to excessive underground cost or if the project is at a remote location on base, the poles for this system of distribution shall be sized to handle the application and shall be wood pressure treated with creosote. Concrete poles shall be reinforced or pre-stressed either cast or spun.

Cross arms for wood poles shall be solid wood, distribution type and shall be sized for the intended load.

Under built services such as low voltage distribution or communications distribution running on the same pole system shall be installed per N.E.C requirements.

Vertical phases for directional changes of the aerial distribution shall be consistent with the base standard and per N.E.C requirements.

Lighting protection for aerial distribution shall be through the use of a combination static and neutral wire.

Site Lighting: Site lighting shall continue to exhibit continuity throughout the Base. See Part IV, Landscape Design Standards, Section 12, for lighting fixture standards.

Grounding: Provide separate grounding conductors and rods for surge (lightning) arrestors and service neutrals. Provide insulated grounding conductors to all grounding type outlets. Metallic conduit shall not constitute a safety ground. Include the following text in the project specifications: *Use three-point ground test and instrumentation. Perform test in presence of the government inspector. Submit results and indicate type of test performed.*

Transformers: Provide service transformers with delta primary and wye secondary connections for three phase services. All service transformers shall have two 2-1.2% taps above and below rated voltage. Provide low %Z transformers where short circuit currents permit. Screen all exterior transformers from major circulation routes or common areas.

Panel Boards: Provide typed panel schedules. Provide manual bypass for all auto transfer generator panels.

15. INTERIOR ELECTRIC

15.A Current Conditions

The current lighting at Holloman vary from ceiling grid mounted 2'x2' and 2'x4' fluorescent fixtures, to ceiling suspended fluorescent fixtures, to recessed and suspended incandescent fixtures.

15.B General Requirements

Provide wire guards for all open fluorescent lamps. Utilize energy saver 32-watt T-8 fluorescent lamps and electronic ballast in administrative and similar areas. Use high-pressure sodium lights in bay areas where color rendition is not vital. Provide seismic zone 2 protection for all fixtures, especially ceiling grid mounted fluorescent fixtures. Provide Certified Ballast Manufacturer (CBM) listed ballast. All ballast shall be electronic and shall have 0.90 power factor or greater and with a total harmonic distribution of <10%.
Emergency lighting in shops and offices shall be ceiling mounted. No wall packs or bug eyes will be allowed.

15.C Approved Products / Materials

Wiring Devices: Provide new devices and plates whenever an area is renovated. All devices shall be recessed except in mechanical rooms and utility areas.

Provide devices rated at 20 amps or greater where heavy use or electrical load dictates the need for 20 amp or greater devices. All wiring shall be copper. No aluminum wire will be allowed.

Automatic Controllers: Provide battery backup for lawn sprinkler system controllers and automatic setback thermostats.

Over current Protective Devices: The minimum sized over current device for branch circuits is 20 amps. Ensure proper coordination and withstand ratings for all over current protection devices. Demonstrate coordination with first upstream existing protective device. Replace old circuit breakers with new when remodeling facilities. If replacement breakers are unavailable, replace the entire panel board. Main fusing is acceptable for limiting short circuit currents; however, place a box with one full set of spare fuses adjacent to main panel.

Electrical Identification: Provide plastic panel board and disconnect labels. Labels shall be laminated (black with white core) engraved with ¼" high letters. Attach to front exterior of enclosures. Labels shall match plan designations. Provide non-ferrous phase and circuit identification labels in all enclosures for feeder circuit conductors. Provide underground marker tapes for all underground conductors. If underground conductors are not in metallic

conduit, provide marker tape with foiled backing to facilitate detection.

Motors: All motors of 5 HP or larger shall have single phasing protection of the type that trips when the phase angle between the three phases is not 120 degrees or on an under voltage condition. All motors of 50 HP or larger shall utilize soft start type.

Power Factor Correction: Add power factor (p.f.) capacitors to induction motors (10 HP or larger) to correct p.f. to 0.90 (+.05, -.00). Switch p.f. capacitors in with the motor. Size capacitor IAW IEEE 141, NEMA MG2 and motor manufacturer recommendations.

Power Service: Power requirements for buildings shall be 208/120 except 480/277 based on building function as an exception.

Electrical Related Work: Balance loads on phases within 10% at all panel boards. Conduit fault calculations to ensure proper withstand ratings for all protective devices. Ensure coordination for all protection devices, conductors, enclosures and equipment.

Raceways: Conduit run in concrete shall be PVC unless steel conduit is needed for a specific reason, i.e. to limit fault currents. Underground primary voltage feeders shall be in concrete encased conduit.

All penetrations of fire resistance rated walls shall be fire stopped IAW NEC Article 300-21.

Highlight compliance with NEC Articles 300-5(g) and 300- 7(1) regarding moisture seals.

Conductors: Aluminum conductors smaller than No. 4 AWG may not be used. In mission critical facilities, housing, dormitories, and transient quarters, aluminum conductors may only be used for service entrances. The smallest branch circuit conductors acceptable are No. 12 AWG. Conductors No. 6 AWG and larger shall have heat resistant insulation.

Conduits: All new utility lines shall be run in underground conduit, provide spare conduits from transformer to building. Underground conduit shall be schedule 40 PVC or better.

Meters: Meters shall be generally located in rear of building or near service entrance. All new buildings shall include meters for all utility uses. Meters shall be SCADA compatible.

Lightning Protection: All new buildings shall have lightning protection designed into the project. Existing buildings fitted with new roofs shall have a lightning protection installed. As a minimum, lightning protection shall be in accordance with NFPA 780. Some functions may require a higher level of protection; check the applicable AFIs for that function.

16. SITE LIGHTING

16.A Current Conditions

Site lighting has generally been approached on a facility or project specific basis rather than as a base wide issue. Building, parking lot and street lighting varies from facility to facility. Rectilinear bronze light fixtures at Building 812 and at the Child Development and Youth Centers respond well to the buildings' architectural character, and begin to create a consistent image.

16.B General Requirements

All lamps shall be high-pressure sodium. Luminaires shall be dark skies compliant.

All poles shall be square, straight steel. For mounting height over 35 feet, a square steel pole, tapered toward the top shall be used.

Luminaries shall be anodized or duranodic bronze aluminum or matching color bronze painted steel finish with appropriate NEMA distribution for its intended function.

All luminaries shall be rectilinear. Roadway luminaries shall be arm mounted.

Average mounting heights shall be as follows:

Sidewalk and plaza lighting - 12’ - 50’

Special purpose lighting - 20’ - 30’

Parking and Roadway lighting - 30’ - 50’

Selection of poles and fixture types for specific functions should be consistent throughout the base.

Lighting levels and installations should vary with the volume and type of traffic and the visual character desired. Use efficient light fixtures to minimize “light pollution” within the Tularosa basin.

Coordinate street and sidewalk lighting locations with site amenities (landscaping, furnishings, signs).

STANDARD LIGHT POLE

16.C Approved Products/Treatments

Luminaries:
EMCO, San Leandro, CA
Infinity II Series – Extruded
Widelite, Inc., San Marcos, TX

Spectra 10 Series

Square, Straight Poles:

Lexington Standard Corp, Eagan, MN
Exact model as required by application.
Square, Tapered Poles:
Valmont Industries, Valley, NB
NAFCO, Fon Du Loc, WI
Exact models as required by application.

17. SECURITY SYSTEMS

17.A Current Conditions

17.B General Requirements

In order to maintain coordinated system growth, security panels for intrusion detection systems shall be installed by Advantor Corporation or an Advantor Corporation certified contractor.

Install ¾ inch conduit from the security panel to the building’s main telephone backboard (home run panel). Install a 24 AWG, four wire, Cat 5 telephone cable in this conduit.

The Security alarm panel must be the Advantor Corporation-ADVANTAGE PLUS BASE MODULE (AVR PLUS BAS-C) with LCD keypad (LCD PLUS AVR). The AVR PLUS BAS-C will be mounted inside the alarmed area. Communication between the Base Plus Module and the Advantage Suite Monitoring System at building 35 must be a Clean Dedicated Pair (Dry), communications line.

The LCD keypad shall be mounted on the inside of the primary entrance of the alarmed area.

Each alarm sensor must have its own alarm point (wired point to point) and be supervised with an End of Line 1000 Ohm resistor. Wiring between the alarm sensors and the AVR BASE PLUS-C will be 22 AWG six wire, unshielded. This wiring must be in conduit and not exposed to tampering.

Balanced Magnetic Switch: Magnetic door contacts should be the Sentrol 2700 series,

Industrial High Security magnetic door contact for regular pedestrian doors. A Sentrol 2500 Series, Wide Gap Contact should be used for aircraft hangar doors and the Sentrol 1515a, Maxi-Gap is recommended for large roll up doors. Each door and motion sensor must send a Tamper alarm if tampered with. Each tamper point shall be supervised with an End of Line 1000 Ohm resistor.

The 49 SFS Electronic Security Systems NCO will perform all software programming necessary for the Advantage Suite monitoring system to communicate with the AVR BASE PLUS-C.

18. MASS NOTIFICATION SYSTEMS

18.A General Requirements

This section described communication system for individual building mass notification system including local operator console, autonomous control unit, battery back-up, notification appliance network including speakers, strobes, wiring and conduit. This building communication system will be connected to the fire alarm control panel. For all new construction projects and for projects which exceeds 50% of original building square footage for renovations/alterations and new additions shall comply with Unified Facilities Criteria (UFC) 4 – 021 – 01 of 18 December 2002, Design and O&M: Mass Notification Systems. Use of existing public address system may be appropriate in buildings if new speakers are not cost effective.

19. TELECOMMUNICATIONS

19.A General Requirements

This section describes telephone, pre-wiring, computer support, and other communication requirements, which must be addressed in the project design. This criteria is as follows:

The latest edition of following documents form a part of Holloman AFB Design Compatibility Standards and are incorporated by the following references:

Engineering Technical Letter (ETL) 02-12:

Air Force Instruction (AFI) 33-133, *Joint Technical Architecture* (Joint Technical Architecture – Air Force [JTA-AF])

AFI 65-601,
Budget Guidance and Procedures, Volume 1.

paragraph 3.4.2 of AFI 32-1032, *Planning and Programming Appropriated Funded Maintenance, Repair, and Construction Projects*.

Building Wiring Architecture, Volume 6, available to .mil clients at

https://www.afca.scott.af.mil/jtaaf/FixedBase/vol6/vol6.htm.

20. CORROSION CONTROL

20.A Current Conditions

Soil and groundwater are very corrosive due to the high concentration of soluble salts. Corrosion of buried steel not receiving appropriate corrosion control is expected to be rapid.

20.B General Requirements

General: Corrosion control of Base facilities includes four basic areas.

a. Cathodic protection
b. Water treatment
c. Protective coating
d. Material selection

Cathodic Protection: Cathodic protection by either sacrifical anodes or impressed current systems is required as identified below. Provide test stations as required by UFC 3-570-02.:

a. Any ferrous material that comes in contact with the earth. This includes but is not

limited to the exterior surface of underground pipes.

b.The interior surface of water storage tanks.

Water Treatment: The following items shall be included as part of water treatment for HVAC facilities:

a.Conductivity meters and chemical feed equipment for condenser water systems on chillers (Open loop system with cooling tower).
b.A pot feeder for closed loop hydronic systems (both hot and chilled water systems).
c.Conductivity metering and chemical feed equipment for boiler water.
d.A bleed-off line with an adjustable flow meter on evaporative coolers. This includes direct as well as multiple stage evaporative cooling units.
e.Sampling ports for the analysis of water conditions.

Protective Coating. Protective coatings shall be applied to the following items:

a.Exterior surface of underground ferrous pipes.
b.Exterior and interior surface of all storage tanks, both above and below ground.
c.Steel structures such as towers and equipment support stands, etc.

Material Selection. Proper selection of materials for a given application can reduce or prevent corrosion. The following are items which are commonly encountered:

a.Schedule 80 black steel pipe shall be used for condensate return lines. The corrosive environment of the steam condensate eats away at the inside of the pipe. The extra thickness of the schedule 80 as compared to the schedule 40 pipe allows added life.
b.Use type "K" copper pipe if the copper pipe shall be used for applications above *120* °F.
c. Polyethylene pipe shall be used for low-pressure natural gas lines along with polyethylene valves.
d. A dielectric union or isolating flange shall be used between pipes of dissimilar metal.

When metal is in contact with water, either above or below ground sacrificial anodes and impressed current systems shall be used; provide test stations and all rectifiers shall be standardized.

PART VII – APPROVED LANDSCAPE PLANTS

Landscaping Plants Allowed on Holloman Air Force Base

Plants for landscaping and/or xeriscaping on HAFB shall be chosen from this list. There is a wide variety of plants available in all size/functionality categories, so there shall be no substitutions of other plants not on this list. Do not substitute different species within the same genus, unless specifically stated (e.g. Acacia sp., Echinocereus sp.). Common and scientific/botanical names are provided to ensure selection of proper species. If further information on a species, whether on this list or not listed, is required, or ideas for companion plantings or substitution recommendations for more "traditionally recognized" landscaping plants is desired, please contact 49 CES/CEV, at 572-3931.

Common Name/ Botanical Name	**Description**	**Culture**
TREES		
Whitethorn acacia, Viscid acacia, Catclaw acacia, Guajillo, Acacia Acacia constricta, A. neovernicosa, A. greggii, A. berlandieri, Acacia sp.	Small tree to large shrub. Most have small ball-shaped flowers in spring or summer. Select species that are cold hardy.	Cold hardiness: varies Soil Type: Adaptable Light: full sun Water: Moderate to low
Sweet acacia Acacia farnesiana	Small deciduous tree 15-30' high. Spreading branches, stems armed with paired straight thorns. Yellow ball-like flowers in Spring.	Cold hardiness: to 20F Soil Type: Adaptable Light: full sun Water: Moderate to low
Netleaf hackberry Celtis reticulata	Small- to medium-sized deciduous tree, to 30' tall and similar width.	Cold hardiness: to –10F Soil type: well drained Light: partial shade to full sun Water: moderate to low
Blue palo verde, Little leaf palo verde, Texas palo verde Cercidium floridum, C. microphyllum, C. texanum	Small deciduous tree, to 25' tall and similar spread. Yellow flowers in summer.	Cold hardiness: to 15F Soil type: well drained Light: full sun Water: moderate to low
Desert willow Chilopsis linearis	Deciduous shrub to 25' tall and 15' wide, can be trimmed up to tree shape. Lavender, pink or white flowers, April through September.	Cold hardiness: to 10F Soil type: well drained, adaptable Light: full sun Water: moderate to low
Chitalpa	Small- to medium-sized	Cold hardiness: to 10F

Chitalpa tashkentensis (Chilopsis X catalpa)	deciduous tree, to 25' tall and 25'wide. White, pink or lavender flowers May to November.	Soil type: well drained Light: full sun Water: low to moderate
Arizona cypress Cupressus arizonica	Large evergreen tree, to 50' with 45' spread. Nice shape with good shade. NOTE: This plant can produce large quantities of pollen during several months, which should be considered prior to selecting for planting.	Cold hardiness: to 0F Soil type: well drained, alkaline adaptable Light: full sun Water: moderate to low
Eucalyptus (Forman's) Eucalyptus formanii	Small evergreen tree, 15' to 25' tall, with 10' to 15' spread.	Cold hardiness: to 15F Soil type: well drained Light: partial shade to full sun Water: low
New Mexico olive, New Mexico privet Forestiera neomexicana	Deciduous shrub 6-8' tall and 8' wide. Fast growing and low maintenance once established.	Cold hardiness: to 0F Soil type: adaptable Alkaline tolerant Light: partial sun to full sun Water: low
Fragrant ash Fraxinus cuspidata	Small deciduous tree to 20' High. Slender tree, with dark green leaves. Clusters of fragrant white flowers in spring.	Cold hardiness: to 0F Soil type: well drained Light: full sun to partial shade Water: low
Gregg ash Fraxinus greggii	Small tree to 25' high, or clump-forming shrub. Olive-green leaves.	Cold hardiness: to 0F Soil type: well drained, adaptable Light: full sun to partial shade Water: low
Texas Ash, Arizona Ash Fraxinus texensis, Fraxinus arizonicus	Deciduous tree, 25' to 40' in height, and 25' to 35' crown.	Cold hardiness: to -20F Soil type: well drained Light: full sun Water: low to moderate
Honey locust (non-thorned) Gleditsia triacanthos var. inermis	Large tree, 40' tall and 40' wide. Attractive shade tree, with fairly open canopy. Round to irregular canopy form. Only use the thornless variety of honey locust.	Cold hardiness: to –20F Soil type: well drained, adaptable Fairly salt tolerant Light: full sun Water: low to moderate

Golden ball lead tree Leucaena retusa	Small- to medium-size tree, 15' to 25' tall and about as wide. Flowers in spring, with yellow golden puffball-like flowers. Often has multiple trunks, but can be trimmed to a single main trunk.	Cold hardiness: to 5F Soil type: adaptable Light: full sun Water: low to none
Arroyo Sweetwood Myrospermum sousanum	Small- to medium sized tree, 15' to 25' tall, and about as wide. Cream colored flowers in spring.	Cold hardiness: to 9F Soil type: adaptable Light: full sun Water: low to moderate
Ironwood Olneya tesota	Small tree to 25' tall and 25' wide. Showy lavender colored flowers in late spring. For use in a very sheltered location, such as a courtyard, only.	Cold Hardiness: to 20F Soil type: well drained Light: full sun Water: moderate to low
Palo verde "Desert Museum" Parkinsonia aculeataXmicrop	Small tree to 25' tall and 25' wide. Has green bark and yellow flowers. Thornless variety.	Cold Hardiness: to 20F Soil type: well drained Light: full sun Water: moderate to low
American pistachio, Texas pistache Pistacia texana	Small, semi-evergreen tree, 25' in height, and 25' in width. Green leaves often will have bronze tips.	Cold hardiness: to –10F Soil type: well drained, adaptable, salt and alkaline tolerant Light: full sun to partial sun Water: low
Texas ebony, Mexican ebony Pithecellobium flexicaule, P. mexicanum	Semi-evergreen, small tree to 20' tall and 20' wide. Dark green foliage with yellow to cream colored flowers in summer. Should be planted against south or west facing areas to catch reflected warmth in winter.	Cold hardiness: to 18F Soil type: well drained, alkaline adapted Light: full sun Water: moderate to low
Mesquite (various species) Prosopis sp.	Deciduous tree or large shrub. Most have flower spikes spring or summer, fruit pods summer through fall. May need to trim lower branches to achieve tree form. Select cold hardy species.	Cold hardiness: varies Soil type: well drained Light: full sun Water: moderate to low

Honey mesquite Prosopis glandulosa	Deciduous tree or large shrub. Can achieve 25' high and 30' wide, though commonly smaller. Yellow flower spikes April and May, fruit pods summer through fall. May need to trim lower branches to achieve tree form.	Cold hardiness: to 0F Soil type: well drained Light: full sun Water: low
Screwbean mesquite Prosopis pubescens	Deciduous tree or large shrub, to 25' high and 25' spread. Spikes of greenish-white flowers, 1½ to 3 inches long.	Cold hardiness: to 0F Soil type: well drained Light: full sun to partial shade Water: low
Velvet mesquite Prosopis velutina	Deciduous tree or large shrub to 20' high and 30' wide, though commonly smaller. Yellow flower spikes spring and summer, fruit pods summer through fall. May need to trim lower branches to achieve tree form.	Cold hardiness: to 5F Soil type: well drained Light: full sun Water: moderate to low
Common hoptree Ptelea trifoliata	Deciduous small tree, to 15' tall and 15' wide. Small white flowers.	Cold hardiness: -30 Soil type: well drained Light: full sun Water: moderate to low
Bur Oak Quercus macrocarpa	Large deciduous tree, 40' to 70' in height, and 35'to 60' wide. Excellent yard tree.	Cold hardiness: to -30 Soil type: well drained Light: full sun to part shade Water: moderate to low
Mexican blue oak Quercus oblongifolia	Semi-evergreen, small tree or large shrub, to 25' tall and 25' wide. Bluish foliage color.	Cold hardiness: to 0F Soil type: well drained, alkaline Light: full sun Water: low
Mexican elder Sambucus mexicana	Medium, semi-evergreen tree, 15-25' tall with a spreading canopy. Clusters of white or cream colored flowers in summer.	Cold hardiness: to 10F Soil type: well drained Light: full sun Water: moderate
Western soapberry Sapindus drummondii	Deciduous tree, 25-30' high and 20-25' wide. Nice shade and good fall color (golden).	Cold hardiness: to –5F Soil type: adaptable Light: full sun Water: low

Texas mountain laurel Sophora secundiflora	Small tree, to 15' in height and 15' in width. Has evergreen, dark glossy leaves, and showy wisteria-like clusters of fragrant, purple flowers in spring. This tree should not be planted in housing areas, as the seeds are poisonous if ingested.	Cold hardiness: to 10F Soil type: well drained, alkaline adapted Light: full sun to partial shade Water: low
Mexican buckeye Ungnadia speciosa	Small deciduous tree, 15' high and 10' wide. Dark green foliage with golden yellow fall color. Profuse showy rosy-pink flowers in spring.	Cold hardiness: to 10F Soil type: adaptable Alkaline tolerant Light: partial sun to partial shade Water: low
Chaste tree Vitex agnus-castus	Small tree, to 15' tall and similar spread. Lilac or white flowered varieties available.	Cold hardiness: to 5 F Soil type: well drained Light: full sun Water: low to moderate
CACTI, ACCENTS, AND OTHER SUCCULENTS		
Lechuguilla Agave lechuguilla	Clumping succulent rosette, to 18" tall and 2' wide. Mature plants (many years old) will send up a flowering stalk, to 14' tall, with yellow flowers. Central (flowering) plant will die-back at that point, but young offsets (pups) will have sprouted at the base of the 'parent' plant.	Cold hardiness: to 0F Soil type: well drained Light: partial sun to full sun Water: none to low
New Mexico agave, Parry agave Agave neomexicana Agave parryi	Clumping succulent rosette, to 2 ½" tall and 3' wide. Mature plants (more than 20 years old) will send up a flowering stalk, to 15' tall, with orange or yellow flowers. Central (flowering) plant will die-back at that point, but young offsets (pups) will have sprouted at the base of the 'parent' plant.	Cold hardiness: to -20F Soil type: well drained Light: full sun Water: none to low

Agave (many available) Agave sp.	Clumping succulent rosettes. Mature plants (many years old) will send up a flowering stalk, most over 10' tall, with yellow flowers. Central (flowering) plant will die-back at that point, but young offsets (pups) will have sprouted at the base of the 'parent' plant.	Cold hardiness: to 0F Soil type: well drained Light: partial sun to full sun Water: none to low
Jelly Palm Butia capitata	Feather palm, to 15' tall.	Cold hardiness: to 10F Soil type: well drained, sandy Light: partial shade to full sun Water: moderate
Sotol Dasylirion wheeleri, Dasylirion sp.	A member of the Agave family. Leaves to 4' tall and 5' wide. A central flower stalk is put up every year.	Cold hardiness: to 5F Soil type: well drained Light: full sun Water: low
Cholla Cylindropuntia sp.	Cacti closely related to prickly pear, growing upright as a shrub 3-8' tall, with elongated pads. Fuschia flowers in spring and summer, yellow fruit buds in summer. Many varieties and species.	Cold hardiness: to –5F Soil type: well drained Light: full sun Water: low
Hedgehog cactus, Rainbow cactus, or Claret-cup cactus Echinocereus sp.	Low growing, clump forming or single columnar cactus, to 16" tall. Large, showy flowers in many colors in spring.	Cold hardiness: to 20F Soil type: well drained Light: full sun Water: low
Fishhook barrel cactus Ferocactus wislizeni	Solitary barrel shaped cactus, to 6' tall and 21" diameter, or more. <u>NOTE: Barrel cactus must have documentation proving nursery grown or salvage origin.</u>	Cold hardiness: to 5F Soil type: well drained Light: full sun Water: low to none
Ocotillo Fouquieria splendens	Unusual deciduous shrub, to 20' tall and 15' spread. Bright reddish-orange	Cold hardiness: to 0F Soil type: well drained, rocky soil preferred

	flowers at tops of stems in spring and early summer.	Light: full sun Water: low to none
Texas false-agave Hechtia texensis	Rosette-forming plant, to about 6" tall and 8" wide, eventually developing offsets with clumps to 18" wide. Medium green leaves, turning reddish in fall. Similar in appearance to true agaves.	Cold hardiness: to 15F Soil type: well drained Light: full sun Water: low
False red yucca, Texas yucca, Coahuilan hesperaloe Hesperaloe parviflora, H. funifera, Hesperaloe sp.	Resembles true yuccas, with narrow leaves, to 3' tall and 5' wide. Attractive red flowers on a tall stalk. (Yellow cultivars also available.)	Cold hardiness: to 0F Soil type: well drained Light: full sun Water: low
Mammillaria cactus Mammillaria sp.	Low growing cacti, most less than 1' high. Showy flowers spring or summer. Nice accent plant.	Cold hardiness: to 15F Soil type: well drained Light: full sun Water: low
Spice lily, Manfreda Manfreda maculosa	Low growing member of the yucca family, to <6" tall and 1' wide with fleshy leaves. Flower stalk to 2' tall with cream colored flowers.	Cold hardiness: to 5F Soil type: well drained Light: full sun Water: Moderate
Beargrass (or sacahuista) Nolina sp.	Grass-like shrub, to 5' tall and Evergreen. Sends up a spike of yellowish flowers late spring.	Cold hardiness: to –5F Soil type: well drained Light: full sun Water: low to none
Prickly pear Opuntia sp.	Cacti with flattened pads, 2-6' tall and 3-15' wide clumps. Showy flowers in many colors, spring and summer. Red to purple fruits summer to fall. Many species are available.	Cold hardiness: to 0F Soil type: well drained Light: full sun Water: low
Banana yucca Yucca baccata	Low growing shrub, stemless rosette to 4'tall and 4' wide.	Cold hardiness: to –5F Soil type: well drained Light: full sun Water: low
Soaptree yucca Yucca elata	Tree like succulent, to 20' and 10' wide. Flowers from May to July.	Cold hardiness: 0F Soil type: well drained Light: full sun

		Water: low
Yucca species Yucca sp.	Many species of yucca are suitable for this area. NOTE: Tree forming yuccas must have documentation proving nursery grown or salvage origin.	Cold hardiness: 10F Soil type: well drained Light: full sun Water: low
SHRUBS		
Catclaw acacia Acacia greggii	Large, spreading shrub to 30' high. Covered with curved thorns. Creamy yellow clusters of flowers in summer.	Cold hardiness: to 0F Soil type: Adaptable Light: full sun Water: low to none
Bee brush, Oreganillo, Spicebush Aloysia gratissima, A. wrightii	Deciduous shrub, 5' to 8' in height and 5' to 8' in width. Leaves are very fragrant, with small fragrant white flowers spring through fall.	Cold hardiness: to 15F Soil Type: adaptable Light: full sun to partial sun Water: low
Triangle-leaf bur-sage White bur-sage Ambrosia deltoidea, A. dumosa	Deciduous shrubs 18" to 2' tall and 2' to 3' wide. Leaves are grey-green or white, with small yellow-green flowers blooming from late winter to spring, and occasionally fall.	Cold hardiness: to 20F Soil type: adaptable Light: full sun Water: moderate to low
Desert honeysuckle, Flame Anisacanthus Anisacanthus thurberi, Anisacanthus sp.	Deciduous shrub, 3-6' high and 4-5' wide. Showy orange. Flowers in summer.	Cold hardiness: to 5F Soil type: well drained Light: full sun to partial shade Water: moderate to low
Sand sage Artemisia filifolia	Evergreen shrub, 3-6' high, 4-6' wide. Leaves are grey-green with a pleasant fragrance.	Cold hardiness: to -10F Soil type: well drained Light: full sun Water: moderate to low
Wormwood, Sagebrush, White sage Artemisia sp.	Low growing to moderate size shrubs, 1-4' high. Most have inconspicuous flowers, with green to grey-green foliage.	Cold hardiness: most to –10F Soil type: well drained Light: full sun Water: moderate to low
Four-wing saltbush Atriplex canescens	Evergreen shrub to 6' tall, 4-8'spread. Inconspicuous flowers. Showy seeds	Cold hardiness: to –10F Soil type: adaptable Alkaline and salt tolerant

	through winter.	Light: sun to partial shade Water: low
Desert broom Baccharis sarothroides	Evergreen shrub, 3-9' high. Female shrubs have showy fruits, fall through winter, a nice 'smoky' appearance.	Cold hardiness: to 15F Soil type: well drained Light: full sun to partial shade Water: moderate to low
Chihuahuan orchid tree Bauhinia congesta	Small semi-deciduous tree, or large deciduous shrub, to 8' tall and 12' spread. Showy lavender to white blossoms.	Cold hardiness: to 10F Soil type: well drained Light: full sun Water: moderate
Red barberry, Algerita Berberis haematocarpa Berberis trifoliolata (Mahonia haematocarpa, M. trifoliolata)	Evergreen spiny-leaved shrub 3-10' tall. Red fruits ripen in fall, attract birds.	Cold hardiness: to 20F Soil type: well drained Light: sun to partial shade Water: low
Woolly butterfly-bush Buddleja marrubiifolia	Low shrub 3-10' tall. Thick and velvety grey-green leaves. Small orange to yellow flowers.	Cold hardiness: to 10F Soil type: well drained Light: full sun Water: moderate to low
Mexican bird-of-paradise Caesalpinia mexicana	Small to medium sized evergreen shrub, to 10' tall and 6' wide. Yellow flowers, spring through fall. Can be trimmed to keep compact.	Cold hardiness: to 20F Soil type: well drained Light: full sun to partial shade Water: low (infrequent deep watering)
Red bird-of-paradise Caesalpinia pulcherrima	Small- to medium-sized shrub to 6' tall and 6' wide, with many bright red and yellow flowers in summer to fall. Plant will likely freeze in winter, so best to cut back to ground-level in late fall (November).	Cold hardiness: to 20F Soil type: well drained Light: full sun Water: low (infrequent deep watering)
Fairy duster Calliandra eriophylla	Semi-evergreen shrub, to 3' high and 4' wide. Red to purple-ish feathery flowers.	Cold hardiness: to 0F Soil type: well drained Light: full sun Water: low
Spiny hackberry, Desert hackberry Celtis pallida	Densely branched evergreen shrub, 4-15' tall. Small, spring flowers, greenish white, attract pollinators, and fruits attract birds.	Cold hardiness: to 10F Soil type: adaptable Light: full sun Water: moderate to low

Winterfat Ceratoides lanata (Krascheninnikovia lanata, Eurotia lanata)	Evergreen shrub, to 4' tall and 3' wide. Foliage is greyish-green, with seeds having dense cottony appearance at ends of branches in fall.	Cold hardiness: to 20F Soil type: well drained Light: full sun to partial shade Water: low
Fernbush Chamaebatiaria millefolium	Deciduous shrub, 4' to 6' in height and 5' wide. Olive-green fern-like foliage with showy white blooms in mid-summer.	Cold hardiness: to 0F Soil type: well drained Light: full sun Water: low
Desert willow Chilopsis linearis	Deciduous shrub to 25' tall and 15' wide, can be trimmed up to tree shape. Lavender, pink or white flowers, April through September.	Cold hardiness: to 10F Soil type: well drained, adaptable Light: full sun Water: moderate to low
Damianita Chrysactinia mexicana	Low growing evergreen shrub to 2' tall, 2' spread. Showy yellow flowers.	Cold hardiness: to 20F Soil type: well drained Light: full sun Water: low
Rabbitbrush, Chamisa Chrysothamnus nauseosus (Ericameria nauseosus)	Low growing evergreen shrub, to 3' tall and 4' wide. Leaves are grey-green with yellow flowers covering entire plant in fall.	Cold hardiness: to –10F Soil type: well drained Light: full sun Water: low to none
Texas olive Cordia boissieri	Deciduous shrub, to 10' tall and 10' wide. Large showy white flowers.	Cold hardiness: to 18F Soil type: well drained Light: full sun Water: low
Little leaf cordia Cordia parvifolia	Deciduous shrub, to 6' tall and 6' wide. Showy white flowers in spring and fall.	Cold hardiness: to 18 F Soil type: well drained Light: full sun Water: low
Rock cotoneaster Cotoneaster horizontalis	Low growing evergreen to semi-deciduous shrub, to 2' tall and 15' spread. Light pinkish white flowers followed by red fruits.	Cold hardiness: to -10F Soil type: well drained Light: full sun Water: low
Cliffrose Cowania mexicana, Purshia stansburiana	Large shrub, to 8' tall and 6' wide. Fragrant yellow blooms during summer. Feathery plumes form after flowering and persist into winter. Tolerant of	Cold hardiness: to -10F Soil type: well drained Light: full sun Water: low

	reflected light and heat.	
Feather indigo bush Dalea formosa	Low growing, semi-evergreen shrub, 3' high and 3' wide. Small violet flowers with yellow throats, Mar through Sept.	Cold hardiness: to 0F Soil type: well drained Light: full sun Water: low
Black dalea Dalea frutescens	Mostly deciduous shrub, 3' tall and 4' wide. Brilliant rose-purple flowers late summer to fall. Attracts butterflies.	Cold hardiness: to 0F Soil type: well drained Light: full sun Water: low
Indigo Bush Dalea pulchra	Evergreen shrub, to 5' tall and 5' wide. Clusters of purple, pea-shaped flowers in spring.	Cold hardiness: to 0F Soil type: well drained Light: full sun Water: low
Indigobush Dalea versicolor	Perennial, mostly evergreen shrub, to 3' tall and 4' wide. Purple flowers in spring.	Cold hardiness: to 0F Soil type: well drained Light: full sun Water: low to moderate
Dicliptera, Hummingbird plant Dicliptera resupinata (Justicia resupinata)	Perennial subshrub, to 2' tall and 4' wide. Shade-loving, with lavender colored flowers all summer.	Cold hardiness: to 20F Soil type: well drained Light: full shade to partial shade Water: moderate
Florida hopbush Dodonaea viscosa	Erect evergreen shrub to 10' tall and 6' wide. Leaves are bright green, with ornamental winged fruits in late summer.	Cold hardiness: to 15F Soil type: adaptable Light: full sun to partial shade Water: low
Joint-fir, Mormon tea Ephedra sp.	Medium-size, evergreen shrubs, usually from 3' to 5' tall, and similar width.	Cold hardiness: to 10F Soil type: well drained Light: full sun Water: low
Turpentine bush Ericameria laricifolia	Low growing evergreen shrub, to 2' tall and 3' wide. Covered in yellow flowers in fall.	Cold hardiness: to 5F Soil Type: well drained Light: full sun Water: low to none
Apache plume Fallugia paradoxa	Clump forming shrub to 8' tall. White flowers in spring and summer, with showy plumes following flowers through fall. Leaves turn yellow in fall.	Cold hardiness: to 0F Soil type: well drained Light: full sun Water: low
Cliff fendler-bush Fendlera rupicola	Deciduous to semi-evergreen shrub to 6' tall.	Cold hardiness: to –10F Soil type: well drained

	Showy white flowers.	Light: sun to partial shade Water: moderate
Tarbush Flourensia cernua	Densely branched, evergreen shrub, to 3' tall and 3' wide. Flowers from September through December. Stems often appear blackish.	Cold hardiness: to 10F Soil type: adaptable Light: full sun Water: low
New Mexico olive, New Mexico privet Forestiera neomexicana	Deciduous shrub 6-8' tall and 8' wide. Fast growing and low maintenance once established.	Cold hardiness: to 0F Soil type: adaptable Alkaline tolerant Light: partial sun to full sun Water: low
California buckthorn, Beech-leaf buckthorn, Sawleaf buckthorn Frangula (Rhamnus) californica, Frangula (Rhamnus) betulifolia, Rhamnus serrata	Evergreen shrubs, to 10' tall and similar spread. Clusters of small greenish-white flowers late spring and early summer.	Cold hardiness: to 15F Soil type: adaptable Light: partial sun to full sun Water: moderate to low
Mexican silktassel, wright silktassel Garrya ovata, G. wrightii	Evergreen shrub, 5-11' tall and 6' wide. Dark green leathery leaves. Showy catkins on male and female plants. Mature plants can be dense and wide.	Cold hardiness: to 10F Soil type: well drained Light: sun to partial shade Water: moderate
Soapbush, Guayacan, Texas lignumvitae Guaiacum angustifolium, G. coulteri	Evergreen shrub or small tree, to 15' tall and 10' wide. Branches tend to have a gnarled appearance. Flowers are blue-purple and fragrant.	Cold hardiness: to 25F Soil type: well drained Light: full sun to partial sun Water: low to moderate
Snakeweed Gutierrezia sarothrae	Semi-evergreen subshrub, to 18" tall and 2' wide. Bright green resinous leaves and clusters of tiny yellow flowers covering the plant June through October.	Cold hardiness: to 0F Soil type: adaptable Light: full sun Water: low to none
Rose of Sharon Hibiscus syriacus	Deciduous shrub, to 10' tall and 6' wide. Showy flowers, available in many colors.	Cold hardiness: to 0F Soil type: well drained Light: full sun to partial shade Water: moderate
Creosote bush	Spindly evergreen shrub, to	Cold hardiness: to 0F

Larrea tridentata	8' tall, and 6' wide. Small yellow flowers spring through fall. Pleasant scent, especially after rainfall.	Soil type: well drained Light: full sun Water: low
Chihuahuan sage Leucophyllum laevigatum	Evergreen shrub, to 6' tall and 5' wide. Covered with ½-1" purple flowers summer through fall.	Cold hardiness: to 10F Soil type: well drained Light: full sun Water: low
Texas sage, Texas ranger, silver cloud, green cloud Leucophyllum sp.	Evergreen shrub, 4-6' tall and 5' wide. Foliage green to grey-green in color. Showy magenta, blue, or purple flowers all summer and fall.	Cold hardiness: to 10F Soil type: well drained Light: full sun Water: low
Wolfberry, thornbush Lycium sp.	Deciduous shrubs, 6' to 10' in height and 5' to 8' wide. Purple to white flowers in spring. Some species densely spinose.	Cold hardiness: to 10F Soil type: well drained Light: full sun to partial shade Water: low
Mariola, Guayule Parthenium incanum, P. argentatum	Low growing evergreen shrub, to 3' tall and 4' wide. The leaves are grey-green, with small pale-yellow flowers.	Cold hardiness: to 10F Soil type: well drained Light: full sun to partial sun Water: low
Desert rosemary mint, Mexican rosemary mint Poliomintha incana, Poliomintha sp.	Semi-evergreen shrub, to 3' tall and 4' wide. Small, fragrant, purple flowers spikes.	Cold hardiness: to 0F Soil type: well drained Light: full sun Water: low to moderate
Western Sand Cherry Prunus besseyi	Deciduous shrub, 3' to 6' in height, and equal spread. White flowers in spring followed by edible purple-black fruits.	Cold hardiness: to -20F Soil type: well drained Light: part shade to full sun Water: moderate to low
Desert scrub oak Quercus turbinella	Slow-growing evergreen shrub, to 8' tall and 12' wide. Leaves are leathery grey-green.	Cold hardiness: to 12F Soil type: adaptable Light: full sun Water: low to moderate
Littleleaf sumac Rhus microphylla	Heavily branched shrub, 3-10' tall. Leaves deciduous. Can be grown into a hedge.	Cold hardiness: to 20F Soil type: well drained Light: full sun Water: moderate to low
Sugar bush Rhus ovata	Large evergreen shrub, to 15' tall and 15' wide. Large white flower clusters in spring. Excellent	Cold hardiness: -10F Soil type: adaptable Light: full sun Water: moderate

	attractant for birds and butterflies.	
Skunkbush sumac Rhus trilobata	A deciduous shrub, to 6' tall. Nice fall foliage (red, copper, and yellow).	Cold hardiness: to –20F Soil type: well drained Light: full sun Water: moderate to low
Autumn amber/Grow low sumac Rhus trilobata 'Autumn Amber' R. trilobata 'Grow Low'	Deciduous, low-growing shrub, to 3' tall and 10' wide. Nice fall foliage colors, can be utilized as a shrubby ground cover.	Cold hardiness: to –20F Soil type: well drained Light: full sun Water: moderate to low
Evergreen sumac, Chihuahuan leather-leaf sumac Rhus virens (Rhus choriophylla)	Spreading shrub, 10-12' tall, 15' wide. Leaves turn maroon in winter, then drop right before new leaves grow again.	Cold hardiness: to 10F Soil type: well drained Light: partial shade Water: moderate to low
Mexican blue sage Salvia chamaedryoides	Low growing perennial, to 18" tall and 18" wide. Blue flowers early summer through November.	Cold hardiness: to 20F Soil type: well drained Light: full sun Water: moderate
Desert sage Salvia dorrii var. dorrii	Perennial shrub to 3' tall and 3' wide. Flowers purple, nice contrast with foliage.	Cold hardiness: -10F Soil type: well drained Light: full sun Water: moderate to low
Mealy cup sage Salvia farinacea	Low growing perennial, to 18" tall and 18" wide. Blue flowers early summer to November.	Cold hardiness: to 24F Soil type: well drained Light: full sun Water: moderate
Autumn sage Salvia greggii	Low growing perennial, to 3' tall. Reddish to magenta flowers spring and fall.	Cold hardiness: to 0F Soil type: well drained Light: full sun to partial shade Water: moderate
Threadleaf groundsel Senecio flaccidus, S. douglassii	Evergreen perennial subshrub, to 3' tall and 2' wide. Foliage is silvery in color, covered with yellow daisy-like flowers April to October.	Cold hardiness: to 0F Soil type: well drained Light: full sun Water: low
Velvet leaf senna, Desert sensitive plant Senna lindheimeriana, (Cassia lindheimeriana)	Perennial, 3' to 6' in height and 2' to 5' in width. Flowers are yellow-orange and blooms from July to	Cold hardiness: to 10F Soil type: well drained Light: full sun Water: moderate to low

	October.	
Shrubby senna Senna wislizeni, (Cassia wislizeni)	Large shrub, 8' tall by 8' wide. Showy yellow flowers in spring.	Cold hardiness: to 0F Soil type: well drained Light: full sun Water: moderate to low
Buffaloberry Shepherdia argentea	Deciduous shrub to 3' tall and 4' wide. Bright red edible berries in fall.	Cold hardiness: to -20 Soil type: well drained Light: full sun to part sun Water: low
Jojoba Simmondsia chinensis	Medium sized evergreen shrub, to 5' tall and 5' wide.	Cold hardiness: to 18F Soil type: well drained Light: full sun Water: low
Garrocha, Argentine tecoma Tecoma garrocha	Large shrub, 10' tall and 6' wide. Semi-deciduous light green leaves with orange, trumpet shaped flowers from summer to fall.	Cold hardiness: to 15F Soil type: well drained Light: full sun Water: moderate to low
Yellow trumpet flower Tecoma stans	Semi-deciduous shrub, to 12' tall and 6' wide. Very showy yellow flowers all season. Also an orange cultivar available.	Cold hardiness: to 10F Soil type: well drained Light: sun to partial shade Water: moderate to low
Arizona rosewood, Chisos rosewood, Narrowleaf rosewood Vauquelinia californica, V. corymbosa	Large evergreen shrub, to 20' tall and 15' wide. Clusters of small, creamy flowers. Attractive foliage.	Cold hardiness: to 0F Soil type: well drained Light: full sun to partial shade Water: moderate to low
Slimleaf goldeneye, Skeletonleaf goldeneye Viguiera stenoloba	Evergreen shrub to 3' tall and 3' spread. Bright green thread-like foliage with yellow daisy-like flowers from spring through fall.	Cold hardiness: to 10F Soil type: well drained, adaptable Light: full sun Water: low
Chaste tree Vitex agnus-castus	Large shrub or small tree, to 15' tall and similar spread. Lilac or white flowered varieties available.	Cold hardiness: to 5 F Soil type: well drained Light: full sun Water: low to moderate
Lotebush Ziziphus obtusifolia	Many branched deciduous shrub, to 6' tall and 8' spread. Stems appear greyish with a waxy coating, and the leaves are grey-green. Small black fruits in late fall are	Cold hardiness: to 15F Soil type: well drained Light: full sun Water: low

	excellent food for birds.	
GRASSES		
Sideoats grama Bouteloua curtipendula	Perennial bunchgrass, to 2' high, and 1 ½' wide. Blooms from April to October. Bluish green foliage dries to tan in fall. Rejuvenate by cutting after dried in fall.	Cold hardiness: to 0F Soil type: well drained Light: full sun Water: moderate to low
Blue grama Bouteloua gracilis	Perennial shortgrass, 10-20" high. Forms a light turf grass and is drought tolerant.	Cold hardiness: to –20F Soil type: well drained Light: full sun to partial sun Water: low
Buffalo grass Buchloe dactyloides	A warm-season grass, forming a uniform and attractive turf (sodgrass). Grows 8-10" high, but maintains a short appearance. Only cut 2-3 times per year, don't over fertilize.	Cold hardiness: to –10F Soil type: adaptable Light: full sun Water: low
Plains lovegrass Eragrostis intermedia	Perennial bunchgrass, to 2' high. Delicate looking seedheads bloom from June to October. Plant has a grey-green to purple-tinged appearance.	Cold hardiness: to 0F Soil type: well drained Light: full sun to partial shade Water: moderate to low
"Regal Mist" muhly Muhlenbergia capillaris	Perennial bunchgrass to 3' tall and 3' wide. Flowering panicles have a pinkish-red, feathery appearance. Plants should be cut to base in late winter (Jan or early Feb).	Cold hardiness: to 0F Soil type: well drained, adaptable Light: full sun Water: low to moderate
Bush muhly Muhlenbergia porteri	Perennial bunchgrass, to 3' high and 4' wide. Flowers summer to fall.	Cold hardiness: 10F Soil type: well drained Light: full sun to partial shade Water: moderate to low
Deer grass Muhlenbergia rigens	Perennial bunchgrass, to 3' high and 4' wide. Has showy, 1-foot long, flowering spikes from July to October. Cut at ground level to rejuvenate clumps.	Cold hardiness: 10F Soil type: well drained Light: full sun Water: moderate to low

Indian ricegrass Oryzopsis hymenoides	Perennial bunchgrass, 1-2' high and 1' wide. Light-green leaf blades fade to straw color in fall. Nice accent plant.	Cold hardiness: to 10F Soil type: well drained Light: full sun to partial shade Water: low
Little bluestem Schizachyrium scoparium	Perennial bunchgrass to 2' tall, and less than 1' wide. Leaf blades and dark blue-green, fall flower stems are reddish. Entire plant turns to rust color in fall.	Cold hardiness: to –15F Soil type: well drained Light: full sun Water: moderate to low
Alkali sacaton Sporobolus airoides	Perennial bunch grass to 3' high and 1 ½' wide. Pale-green leaf blades taper to a long slender tip. Open seedhead panicle from May through October.	Cold hardiness: -10F Soil type: heavy, silty or clayey soils are preferred Alkaline tolerant Light: full sun Water: moderate to low
New Mexico feathergrass Stipa neomexicana	Perennial bunchgrass to 30" tall and 1' wide. Silky awns on seeds are very attractive accents.	Cold hardiness: to –15F Soil type: well drained Light: sun to partial shade Water: moderate to low
GROUNDCOVERS		
Fringed sage Artemisia frigida	Low growing groundcover, to 2' high. Leaves are grey-green with a pleasant fragrance.	Cold hardiness: to -20F Soil type: well drained Light: full sun Water: moderate
'Centennial' desert broom Baccharis pilularisXsarothroides	Low growing grey-green shrub, 3' high to 5' wide. Evergreen.	Cold hardiness: to 15F Soil type: well drained Light: full sun Water: moderate to low
Winecups Callirhoe involucrata	Low growing herbaceous perennial, to 2' tall and 2' wide. Flowers are a rich-pinkish red color with a white center. Re-seeds itself and will slowly fill in an area as groundcover.	Cold hardiness: to 10F Soil type: adaptable to most soils Light: full sun, can take some reflected light Water: low
Trailing yellow dalea, Trailing indigo bush Dalea capitata, D. greggii	Low growing shrub, 6" to 1' tall and 3' to 4' wide. Yellow, lemon-scented flowers in late spring and fall.	Cold hardiness: to 5F Soil type: well drained Light: full sun Water: low
Creeping juniper Juniperus horizontalis	Low growing shrub 6" to 12" in height, with a spreading habit. Evergreen.	Cold hardiness: to -20 Soil type: well drained Light: full sun

		Water: low
Drooping lobelia, Loose-flower lobelia Lobelia laxiflora	Perennial low growing shrub, to 2' tall, spreading by underground runners. Red flowers in spring.	Cold hardiness: to 20F Soil type: Well drained Light: full sun Water: low to moderate
Desert four o'clock Mirabilis multiflora .	Low growing herbaceous perennial, to 2' high. Showy, fragrant magenta flowers in summer. Takes on shrub-like appearance. Attracts birds, bees, and butterflies.	Cold hardiness: to –10F Soil type: adaptable Light: sun to partial shade Water: moderate to low
Evening primrose species Oenothera sp.	Low growing herbaceous perennial, to 1-2' high. Multiple colors of flowers, spring through summer. Attractive to birds, bees, and butterflies.	Cold hardiness: to –10F Soil type: well drained Light: full sun (some partial shade) Water: moderate
Orange zexmenia, Shortleaf jefea, San Pedro daisy Zexmenia sp., Jefea sp., Wedelia sp., Lasianthaea sp.	Low growing shrubby perennial, to 2' high and 3' wide. Yellow to sunflower-like blossoms from spring to fall.	Cold hardiness: to 20F Soil type: well drained Light: full sun to partial shade Water: low to moderate
VINES		
Coral vine Antigonon leptopus	Fast-growing vine, grows to 25' length and 25' width. Leaves are heart-shaped, with pink, red or white flowers midsummer to fall. Can be planted as a fence cover, but do not plant so it will climb buildings nor other plants.	Cold hardiness: to 20F Soil type: adaptable Light: full sun to partial sun Water: moderate to low
Trumpet creeper Campsis radicans	Vigorous growers, to 30' length and width. Showy red-orange flowers are very attractive to hummingbirds.	Cold hardiness: to -10F Soil type: adaptable Light: full sun to shade Water: moderate
Western virgin's bower, old man's beard, Bigelow's leather flower Clematis ligusticifolia, C. drummondii, C. bigelovii	Native vine, to 20' length and 10' width. White flowers in summer and plumose showy fruits late summer to fall. Can be planted as a fence cover, but do not plant so it will climb buildings nor other plants.	Cold hardiness: to 0F Soil type: well drained Light: full sun Water: low

Purple orchid vine, yellow orchid vine Mascagnia lilacina, M. macroptera (Callaeum lilacina, C. macroptera)	Vine growing from 6' to 30' length and similar width. Purple flowers or yellow flowers in late spring. Plant as a fence cover, but should not plant so it will climb buildings nor other plants.	Cold hardiness: to 15F Soil type: well drained Light: full sun Water: low to moderate
Little snapdragon vine Maurandya antirrhiniflora (Maurandella antirrhiniflora)	Delicate vine growing 6' to 10' in length. Small light green leaves with magenta to deep violet snapdragon flowers in summer. Does best when provided a trellis to grow upon.	Cold hardiness: to 20F Soil type: well drained, adaptable Light: full sun to partial shade Water: low to moderate
Virginia creeper Parthenocissus quinquefolia	Large native vine, to 25' in length and 25' in width. Lush green leaves, with fall foliage a deep red color. May need be trimmed regularly. Plant as fence cover, not where it will climb buildings or other plants.	Cold hardiness: to –30F Soil type: well drained Light: partial shade to full sun Water: low
American wisteria, Texas wisteria Wisteria frutescens	Small to medium native vine, 8' to 20' length. Clusters of light purple to violet flowers in spring. May need some regular trimming, plant where it can climb.	Cold hardiness: to -10F Soil Type: well drained Light: partial shade to full sun Water: moderate
OTHER FLOWERS		
Moonshine yarrow, western yarrow (many cultivars) Achillea millefolia	Distinctive silver grey foliage on this low growing plant, to 18" to 3' tall and 18" wide. Flowers vary in color from cream to yellow to pink.	Cold hardiness: to –20F Soil type: well drained Light: full sun to partial shade Water: moderate
Giant hyssop Agastache cana	Low growing plant to 2' tall and 2' wide. Rose-pink flower spikes from July through September, with fragrant leaves. Attracts hummingbirds.	Cold hardiness: to –20F Soil type: well drained Light: full sun to partial sun Water: moderate to low
Licorice mint hyssop	Low growing plant to 2' tall	Cold hardiness: to –10F

Agastache rupestris	and 2' wide. Orange flower spikes from July through September, with fragrant threadlike grey-green leaves.	Soil type: well drained Light: full sun to partial sun Water: moderate to low
Flattop ageratum, Butterfly mist Ageratum corymbosum	Low growing perennial, to 18" tall and 4' spread. Blue to lilac flowers that attract butterflies.	Cold hardiness: to 15F Soil type: well drained Light: Full sun to partial shade Water: Moderate
Columbine Aquilegia sp.	Attractive fern-like foliage. Showy flowers, many colors available. Grows to 3' tall and 18" wide.	Cold hardiness: to –30F Soil type: well drained Light: partial shade Water: moderate to high
Prickly-poppy Argemone sp.	Short-lived perennial, to 3' tall and 2' wide. Showy white or yellow flowers with crepe paper-like petals. Foliage and stems are covered with yellow stems.	Cold hardiness: to 15F Soil type: well drained Light: full sun Water: low
Milkweed, Butterfly milkweed Asclepias sp., A. tuberosa	Perennial, to 2' tall. Clusters of orange, yellow or pink flowers at the top of the plant from spring to fall.	Cold hardiness: to 0F Soil type: well drained Light: full sun Water: moderate to low
Bahia Bahia absinthifolia	Perennial, to 1' tall and 18" wide. Yellow flowers above silvery foliage. Blooms in spring and fall.	Cold hardiness: to 15F Soil type: well drained Light: full sun Water: low
Desert marigold Baileya multiradiata	Short lived perennial, to 12" tall. Bright yellow flowers, spring and summer, with greyish foliage.	Cold hardiness: to 0F Soil type: well drained Light: full sun Water: low to none
Chocolate flower Berlandiera lyrata	Attractive perennial, to 20" tall. Yellow flowers with brown centers, scent similar to chocolate.	Cold hardiness: to 10F Soil type: well drained Light: full sun to partial shade Water: moderate to low
Sundrops Calylophus sp.	Perennial wildflower to 18" tall and 18" wide. Profuse bloomer, with yellow flowers spring through summer. Foliage is grey-green. Shear tops of plants off before growing season starts (Feb or Mar).	Cold hardiness: to 10F Soil type: well drained, adaptable Light: partial sun to full sun Water: low

Coreopsis, Calliopsis Coreopsis tinctoria	Upright annual, 2-3' tall. Red and yellow flowers in spring.	Cold hardiness: n/a Soil type: well drained Light: full sun Water: moderate to low
Shrubby dogweed, dogweed Dyssodia sp. (Thymophylla sp.)	Herbaceous perennial or subshrub, 6" tall and about 1' wide. Yellow daisy-like flowers from April through October.	Cold hardiness: 10F Soil type: adaptable Light: full sun Water: low
Purple coneflower Echinacea purpurea	Upright perennial, to 3' tall. Purple to white flowers.	Cold hardiness: to –20F Soil type: well drained Light: partial shade to full sun Water: moderate
Mexican gold poppy Eschscholzia mexicana	Low growing perennial or annual. Yellow and cream colored flowers, with grey-green foliage.	Cold hardiness: n/a Soil type: well drained Light: full sun Water: moderate
Blanketflower Gaillardia sp.	Perennial. Red or orange flower petals with yellow tips, or yellow petals.	Cold hardiness: to –20F Soil type: well drained Light: full sun Water: moderate
Gaura Gaura lindheimeri	Herbaceous perennial, 2' to 4' in height, with 2' to 4' width. White or pink flowers from June through September.	Cold hardiness: to –10F Soil type: well drained Light: full sun Water: moderate
Purple verbena, Sand verbena Glandularia wrightii Glandularia sp. Verbena sp.	Low growing perennial. Purple to magenta flowers clusters in summer.	Cold hardiness: to 15F Soil type: well drained Light: full sun Water: low
Maximillian sunflower Helianthus maximilianus	Tall plant, to 8' tall, for placement along hedges or edges of yards. Twenty to thirty spikes of 30 or more yellow, daisy-like flowers	Cold hardiness: to –20F Soil type: well drained Light: full sun Water: moderate
Angelita daisy Hymenoxys acaulis	Low growing shrub, to 1' tall. Yellow flowers in summer.	Cold hardiness: to 10F Soil type: well drained Light: full sun Water: moderate
Perky sue, four-nerve daisy Hymenoxys argentea, Tetraneuris scaposa	Low growing perennial, to 1' tall. Yellow flowers from April through August.	Cold hardiness: to 10F Soil type: well drained Light: full sun to partial shade

		Water: low
Dotted gayfeather Liatris punctata	Perennial plant to 2 ½' tall. Rose-purple flowers on a spike summer to fall.	Cold hardiness: to –10F Soil type: well drained Light: full sun Water: moderate to low
Blue flax Linum lewisii	Perennial, to 3' tall. Blue flowers late spring to summer. Trim back each winter.	Cold hardiness: to –20F Soil type: well drained Light: full sun to partial shade Water: moderate
Tansy aster Machaeranthera bigelovii	Low growing plant, 1-3' tall. Bright purple to deep magenta flowers late summer to fall.	Cold hardiness: to 0F Soil type: well drained Light: full sun Water: moderate
Blackfoot daisy Melampodium leucanthum	Short-lived perennial to 1 ½' tall and 2' wide, mound shape. Has fragrant white flowers, March to November.	Cold hardiness: to 0F Soil type: well drained Light: partial shade to full sun Water: moderate to low
Rock rose Pavonia lasiopetala	Short-lived, deciduous to semi-evergreen, perennial to 3' tall and 3' spread. Rosy pink flower from April to October. Should be cut back annually (to ~4" of base) in late winter (February). Can be allowed to self-seed. Attractive to butterflies.	Cold hardiness: to 5F Soil type: well drained Light: full sun to partial shade Water: low to moderate
Beardtongue, Penstemon Penstemon sp.	Perennial plants, 1-3' tall. Many varieties and flower colors available. Most are showy and add good color.	Cold hardiness: to 0F Soil type: well drained Light: full sun to partial shade Water: moderate to low Needs to be heat tolerant.
Wooly paperflower, Paperflower Psilostrophe tagetina, P. cooperi	Low growing perennial, to 1' tall and 18" spread. Covered with bright yellow flowers March through September.	Cold hardiness: 15F Soil type: well drained Light: full sun Water: low
Mexican hat Ratibida columnaris	Perennial to 2' tall. Brown-orange flower petals with yellow tips late spring to	Cold hardiness: -30F Soil type: well drained Light: full sun

	early fall. Cut stems to ground each winter.	Water: moderate to low
Black-eyed susan Rudbeckia hirta	Biennial or annual plant to 3' tall. Red-orange flower petals with yellow tips summer to fall.	Cold hardiness: to –10F Soil type: well drained Light: partial sun Water: moderate
Salvia, Sage Salvia sp.	Low growing perennial or annual, to varying heights. Most have showy flowers either spring, summer, or fall.	Cold hardiness: to 0F Soil type: well drained Light: full sun to partial shade Water: moderate
Globe-mallow Sphaeralcea sp.	Shrubby perennial to 3' tall and 3' wide. Flowers can be shades of orange, red, yellow, or pink.	Cold hardiness: to 20F Soil type: well drained Light: full sun Water: moderate to low
Mt. Lemmon marigold, Copper Canyon daisy Tagetes lemmonii	Upright perennial shrub, to 3' tall and 4' wide. Golden yellow daisy-like flowers in spring and fall. Very fragrant foliage. Dies back to ground in winter.	Cold hardiness: to 20F Soil type: well drained Light: full sun Water: moderate
Dutchman's breeches, Turpentine broom Thamnosma sp.	Woody perennial to 12" tall and 18" spread. Yellow urn-shaped petals March through May.	Cold hardiness: to 15F Soil type: well drained Light: full sun Water: low
California trixis, American threefold Trixis californica	Evergreen subshrub, to 2' tall and 3' wide. Bright green lance-shaped leaves with yellow flowers in spring and fall. Plant can be trimmed to base to rejuvenate in spring or summer, but not fall.	Cold hardiness: to 20F Soil type: well drained Light: full sun Water: low to moderate
Goodding verbena Verbena gooddingii	Fast growing perennial to 2' and 4' wide. Purple blossoms from spring to fall. After flowers fade, cut those stems off to keep from looking straggly.	Cold hardiness: to 15F Soil type: well drained Light: full sun Water: moderate
Golden Eye Viguiera deltoidea	Evergreen shrub to 3' tall and 3' wide. Pale yellow to white flowers with yellow centers.	Cold hardiness: to 20F Soil type: well drained Light: full sun Water: moderate to low
Rain lily	Perennial lily, 8" tall and	Cold hardiness: to 5F

Zephyranthes sp.	20" wide. White, pink, peach or yellow flowers that emerge in summer following rainfall.	Soil type: well drained Light: full sun to part shade Water: moderate to low
Desert zinnia Zinnia acerosa	Perennial to 10" tall and 2' wide. White flowers in spring.	Cold hardiness: to 20F Soil type: well drained Light: full sun Water: low
Prairie zinnia Zinnia grandiflora	Perennial to 1' tall. Many bright yellow flowers from late spring to early fall.	Cold hardiness: to 20F Soil type: well drained Light: full sun Water: moderate to low